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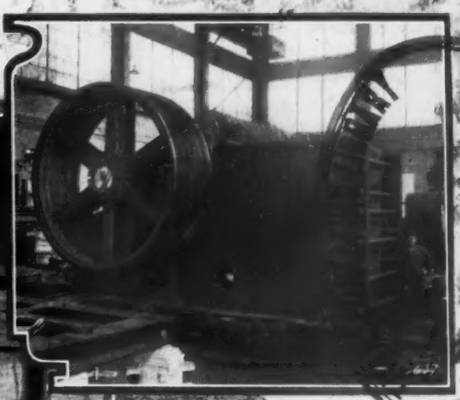
Rock Products

With which is Incorporated **CEMENT and ENGINEERING NEWS** Founded 1896

Chicago, June 7, 1930 | Issued Every Other Week | Volume XXXIII, No. 12

BUCHANAN CRUSHER At Safe Harbor Penna.



UNIVERSITY OF MICHIGAN

ON the Susquehanna River there is a location known as Safe Harbor. At this point a hydro electric development was planned and for this purpose a large dam is being constructed nearly a mile wide by the Arundel Corporation of Baltimore for the operators, the Safe Harbor Water Power Corporation.

When taking over the work the Arundel engineers realized that the rock at the dam location that would have to be utilized for the project was an extremely hard trap of very massive formation, and the problem of crushing this material made the choice of a suitable crusher a very serious consideration. The primary crusher must have a large receiving opening to handle the massive rock and be of extremely rugged design to stand up on the hard material. After a very thorough investigation a 56″ x 72″ BUCHANAN Type "C" All-Steel Crusher was chosen principally because of its known dependability and unfailing record of continuous production for other important installations of like character.

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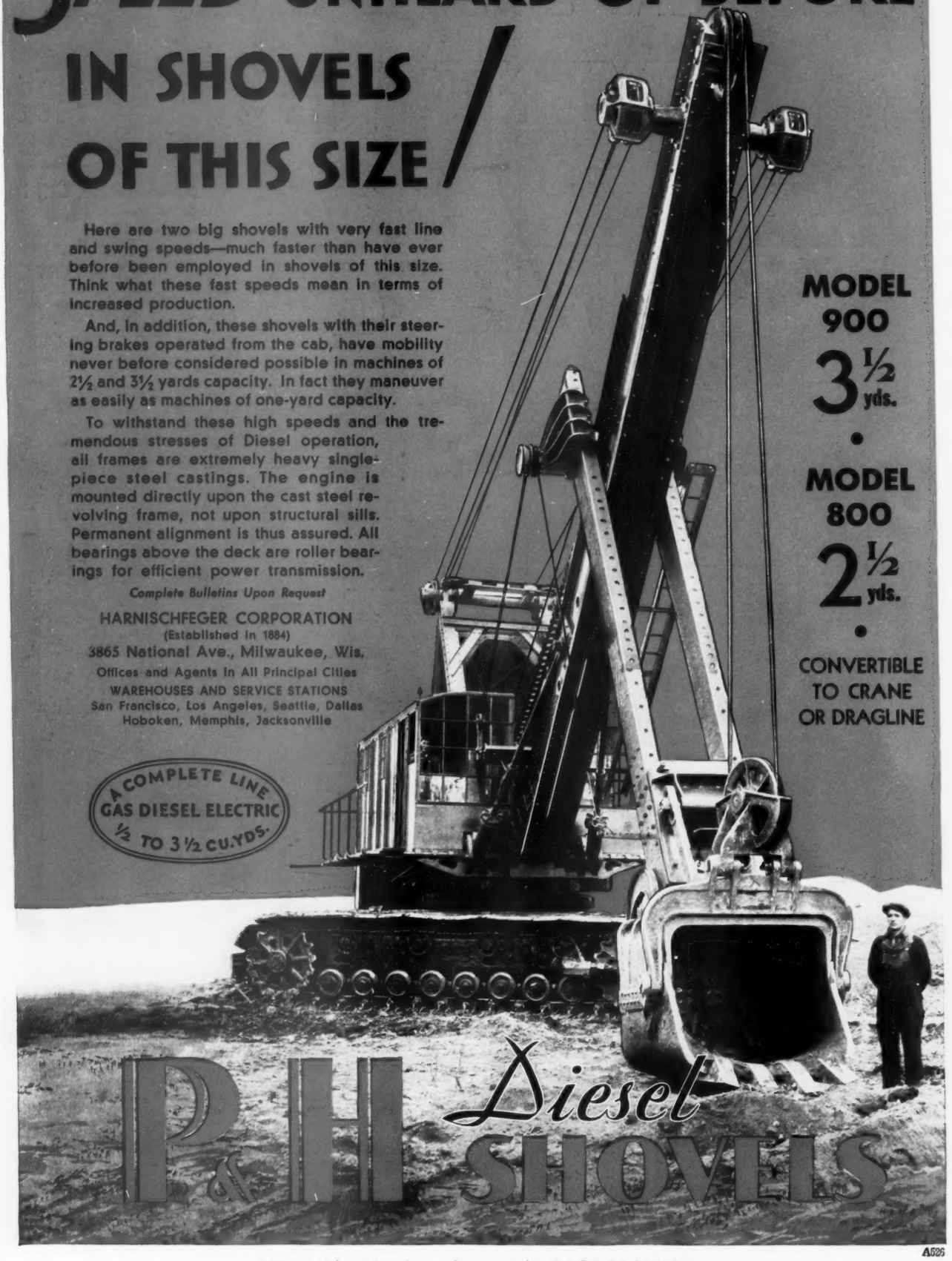

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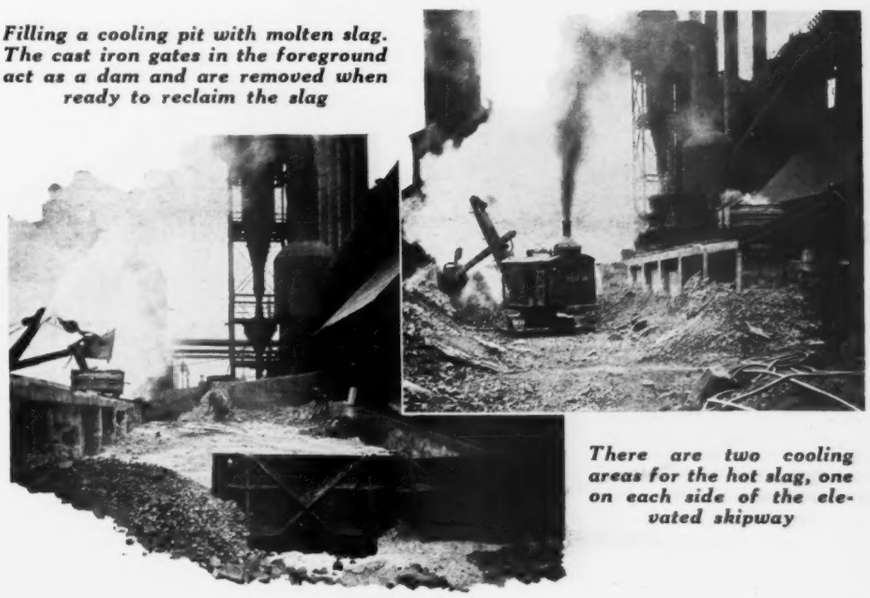
Volume XXXIII | Chicago, June 7, 1930 | Number 12

Southwestern Ohio Sand, Gravel and Slag Activities

American Materials Corporation's New Gravel Plant and Slag Plants at Hamilton

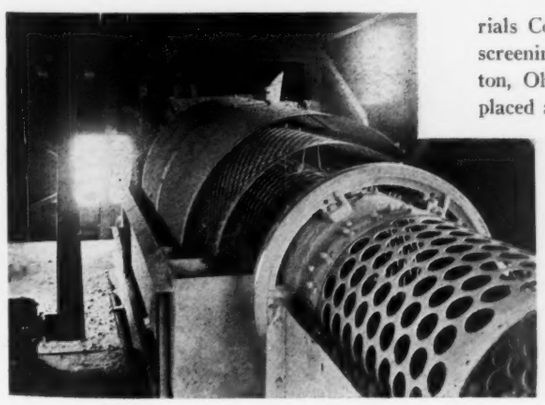
THE DISTRICT centering around Hamilton, Ohio, is one of the most intense industrial sections of the state, being only outdistanced in that respect by the Cleveland district. In addition to the industrial demands there has been a large tonnage of ballast sold in the district and a fair volume of commercial aggregate. In this Cincinnati territory the Consolidated Terminals, which is a consolidation of the four railroad terminals into one, will entail the elevation and relocation of trackage that will have an estimated cost of $150,000,000 and require four to five years to complete. It is expected that this work will call for a large tonnage of structural material, sand and gravel, etc. Freight rates into Cincinnati from the Hamilton district are as low as for any of the producers shipping there and in some cases lower.

Sensing the future demand for sand and gravel in that district, the American Materials Corp. has recently completed a new screening and washing plant at Hamilton, Ohio. The same company has also placed a new slag plant in operation near the sand and gravel plant.



Filling a cooling pit with molten slag. The cast iron gates in the foreground act as a dam and are removed when ready to reclaim the slag

There are two cooling areas for the hot slag, one on each side of the elevated skipway



One of the multiple-jacketed rotary screens in the slag plant

Construction work on the gravel plant, which represents an investment of about $350,000, was started July 20, 1929, and the plant was placed in operation October 5. The slag plant, costing about $200,000, was also put up in record time. Its construction started April 22 and it went into operation on July 15. Both the plants are built of reinforced-concrete and steel throughout.

Sand and Gravel Plant

The plant uses rotary screens for preliminary sizing and for the separation of the larger sizes of crushed gravel and for the preliminary classification of the sand. A double-decked, 3-ft. by 6-ft., Simplicity vibrating screen is installed to handle the re-screening of the smaller gravel sizes. The rotary screens were made in the shops of the Greenville Manufacturing Works and have shorter trunnions than usual on the rollers, with thrust bearings below. These changes in design have considerably improved the mechanical construction of the screen,

Indicating the character of the gravel deposit at Hamilton

mainly through added strength and simplification of the structural details.

The plant is equipped to furnish uniform sizes of products from each of the various perforations, and also to furnish intermediate mixtures of materials of the various sized products. Part of this mixing is done by re-elevating and mixing in the chutes after rewashing on the "Simplicity" vibrating screens.

Ample car storage facilities both above and below the plant have been provided holding 60 cars above and 60 below the plant, with the two loading tracks passing under the bins. The tracks past the bins have a grade of 1½%, so that empties and loads can be moved to and from the plant by gravity. The plant has a capacity of 3000 to 3500 tons per 10-hour day and requires 17 men for capacity operation.

Water is supplied from a deepened portion of the gravel pit by two Allis-Chalmers centrifugal pumps, one 8-in., delivering 2300 g.p.m. at 104-ft. head, and the other 6-in., delivering 1200 g.p.m. at 80-ft. head. The larger pump is direct-connected to a 100-hp. Allis-Chalmers motor and the smaller connected to a 25-hp. electric motor. About 50% of the water is used in the 60-in. gravel screen and 25% each in the crushed gravel or stone and the sand screens.

A feature of interest in connection with the pipe work in this plant was the use of electric and oxy-acetylene welding for fabricating pipe elbows, complicated reducers and other fittings. By the use of the welding torch a header pipe connection was made and at far less cost than would have been the case had standard fitting been used. The Hamilton operation includes in the shop equipment a Gibbs welding machine and an oxy-acetylene outfit.

The Gravel Deposit

The deposit is located about three miles north of town and is practically bounded by the rails of the Baltimore and Ohio, the Pennsylvania and the I. C. and E. Traction Co. railroads, affording ample rail shipping facilities, and covers 125 acres.

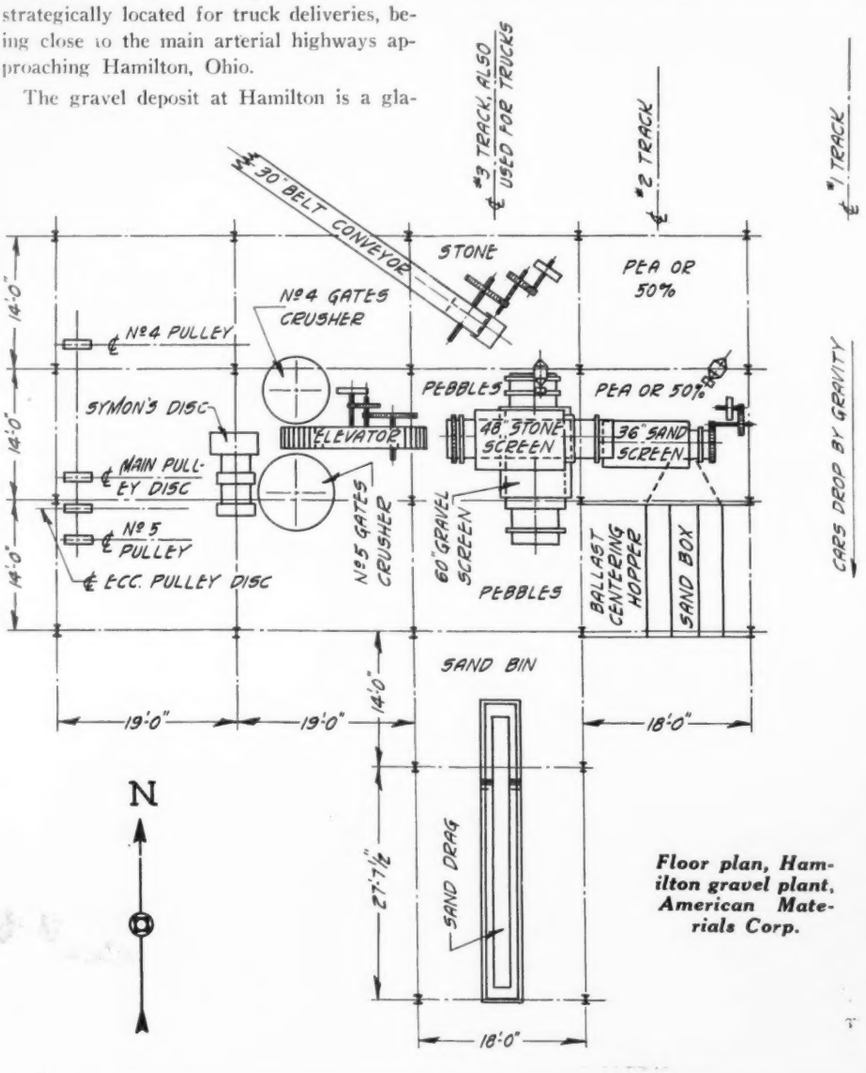
Both the slag and the gravel plants are strategically located for truck deliveries, being close to the main arterial highways approaching Hamilton, Ohio.

The gravel deposit at Hamilton is a glacial drift deposit containing granite, quartz and hard limestone particles with no ordinary sandstones in the beds. The gravel is clean and has a high percentage of white pebbles.

The deposit will average about 60% gravel and 40% minus ¼-in. Between 30% and 35% of the gravel is over 1½-in. and needs to be recrushed, but none is over 4 in. in diameter.

About 10% of the total area has 4-ft. of soil overburden, and the remaining 90% is covered with about 12 in. of soil. The overburden has been removed from a large area. The deposit has been explored to a 55-ft. depth and persists to that depth throughout the area and of this total depth 20 ft. is above water level and 35 ft. below.

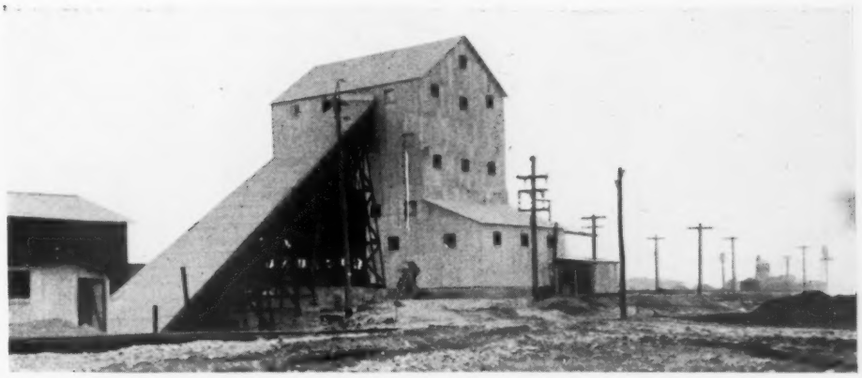
Loading is done by a class 24, Bucyrus steam dragline mounted on trucks, with a



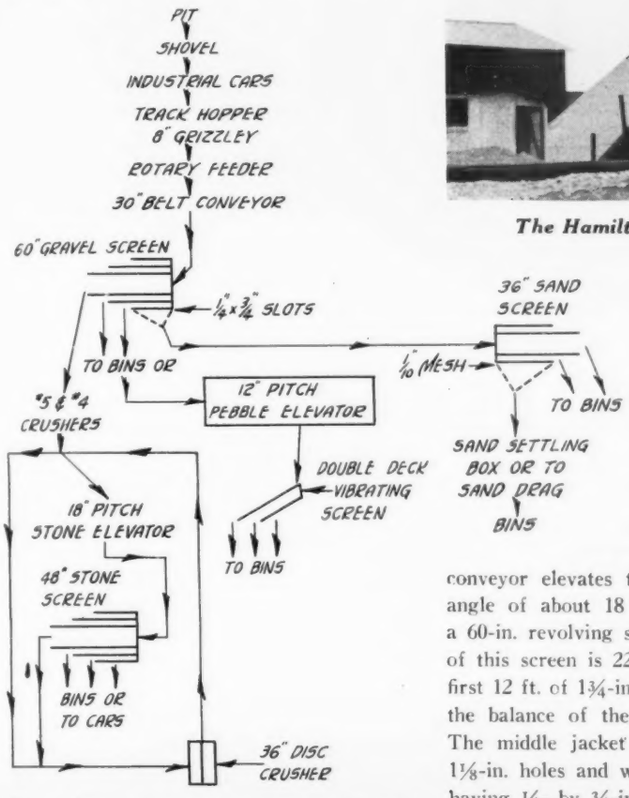
Floor plan, Hamilton gravel plant, American Materials Corp.

Car loading arrangements at the Hamilton plant

100-ft. boom and a 4-yd. bucket. This shovel also strips, casting the stripping over the bank, into the water, away from the toe of slope of good gravel. The gravel is hauled to the plant in 25-yd. center dump cars with a 20-ton Davenport steam locomotive.



The Hamilton, Ohio, sand and gravel plant, American Materials Corp.

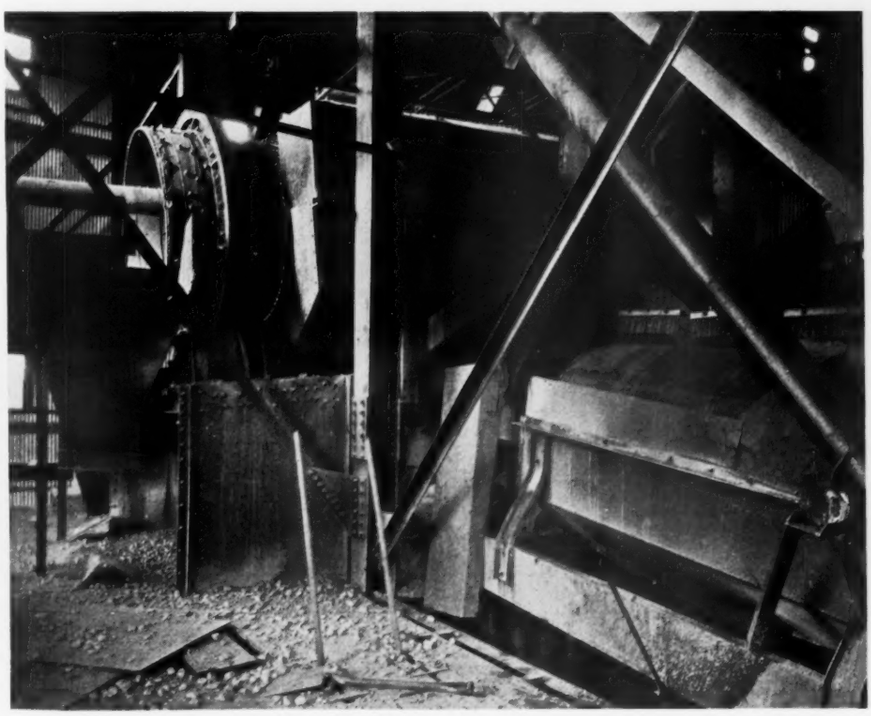


Flow sheet of operations at the Hamilton, Ohio, gravel plant

The cars from the pit are dumped through an 8-in. grizzly to a track hopper under which is a drum-type feeder feeding a 30-in. belt conveyor, having a center to center length of 250 ft. The drum feeder is driven from the tail pulley of the belt conveyor. The conveyor elevates the material through an angle of about 18 deg. and discharges to a 60-in. revolving screen. The main barrel of this screen is 22 ft. 9 in. long, with the first 12 ft. of 1¾-in. round perforations, and the balance of the length is ¾-in. round. The middle jacket is 11 ft. long and has 1⅛-in. holes and with a 10-ft. outer jacket having ¼- by ¾-in. slotted wire.

The oversize from the gravel screen is chuted to a No. 4 and a No. 5 Style K, Gates crusher, both of which discharge to an 18-in. pitch bucket elevator that elevates the crushed material approximately 60 ft. to the top of the building and discharges to a 20-ft. 9-in. by 48-in. rotary screen. The inner barrel of this screen has 12 ft. of 1¾-in. round perforations, middle jacket 11 ft. of ¾-in. perforations and the outer jacket 10 ft.

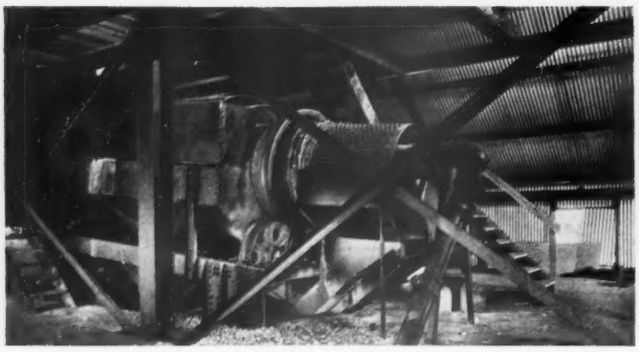
Crusher feed and guard at the Hamilton plant



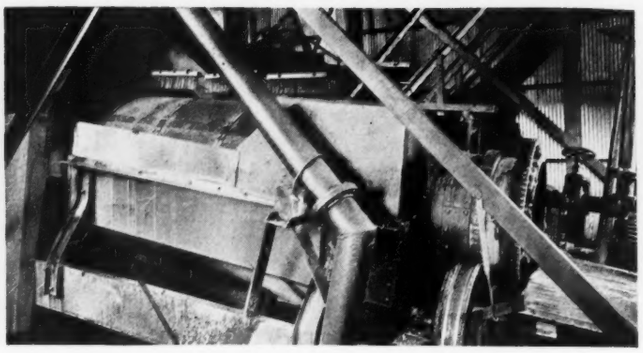
Discharge end of the gravel screen (upper left) and at the right, the sand screen, Hamilton gravel plant

of ¼-in. perforations. The two crushers also can discharge to a 36-in. Symons disk crusher, in which event the disk crusher discharges to the boot of the same 18-in. pitch, supercapacity elevator mentioned. The various sizes from the stone screen are chuted to bins. The sand is chuted to the 36-in. rotary sand screen following the main gravel washing operation.

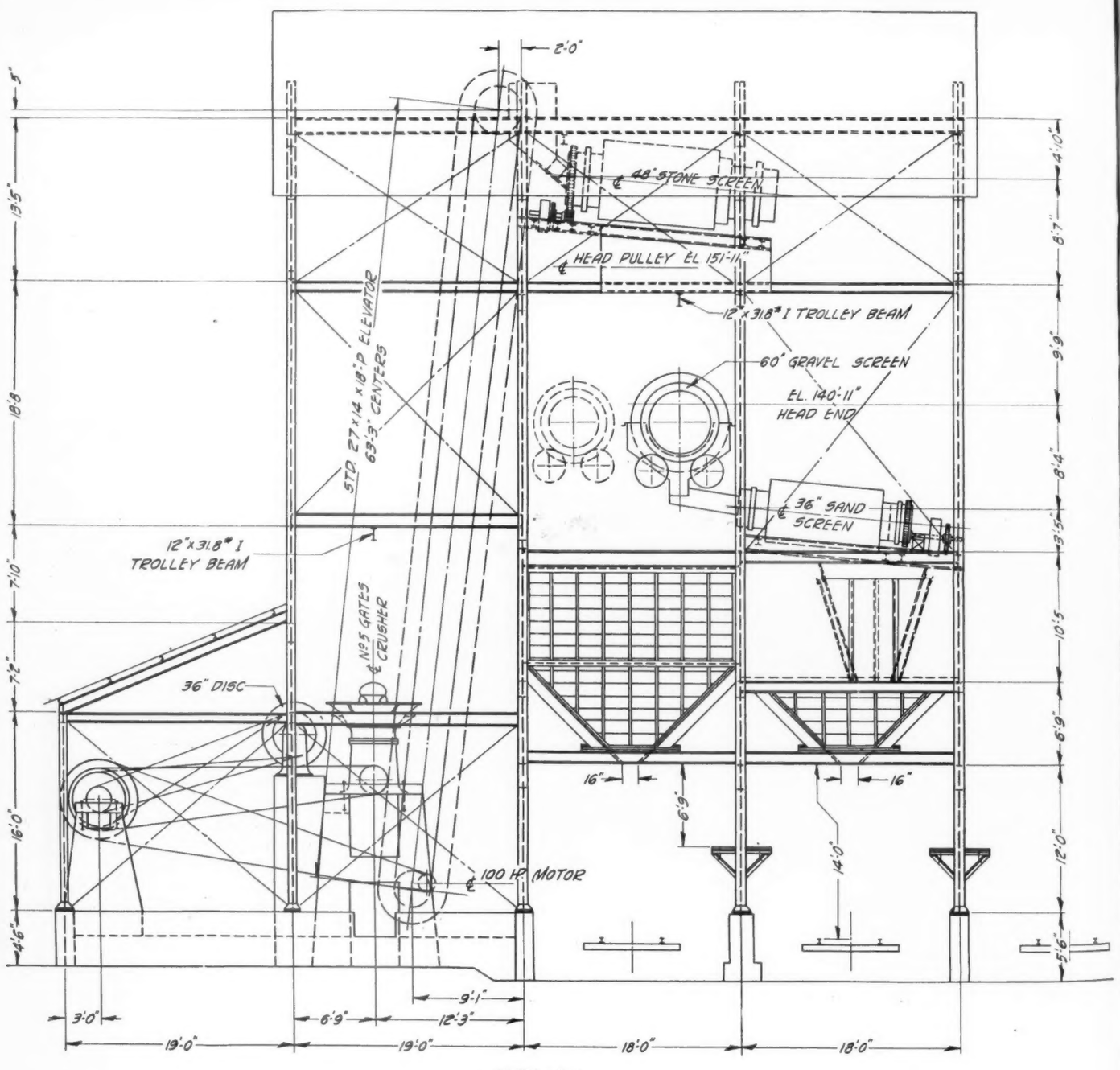
Returning to the first screening operation, that using the 60-in. gravel screen: The pebble sizes of gravel from this screen can fall direct to bins or to a 12-in. pitch bucket elevator operating on 30-in. centers, which discharges to a 3-ft. by 6-ft. double-decked Simplicity screen that acts as a final cleaner



Stone screen handling crushed gravel, Hamilton



Sand screen, 36 in. by 14 ft., at the Hamilton plant



SOUTH VIEW

South elevation of the Hamilton, Ohio, sand and gravel plant, American Materials Corp.

for the pebble sizes or can be used for making specially sized products.

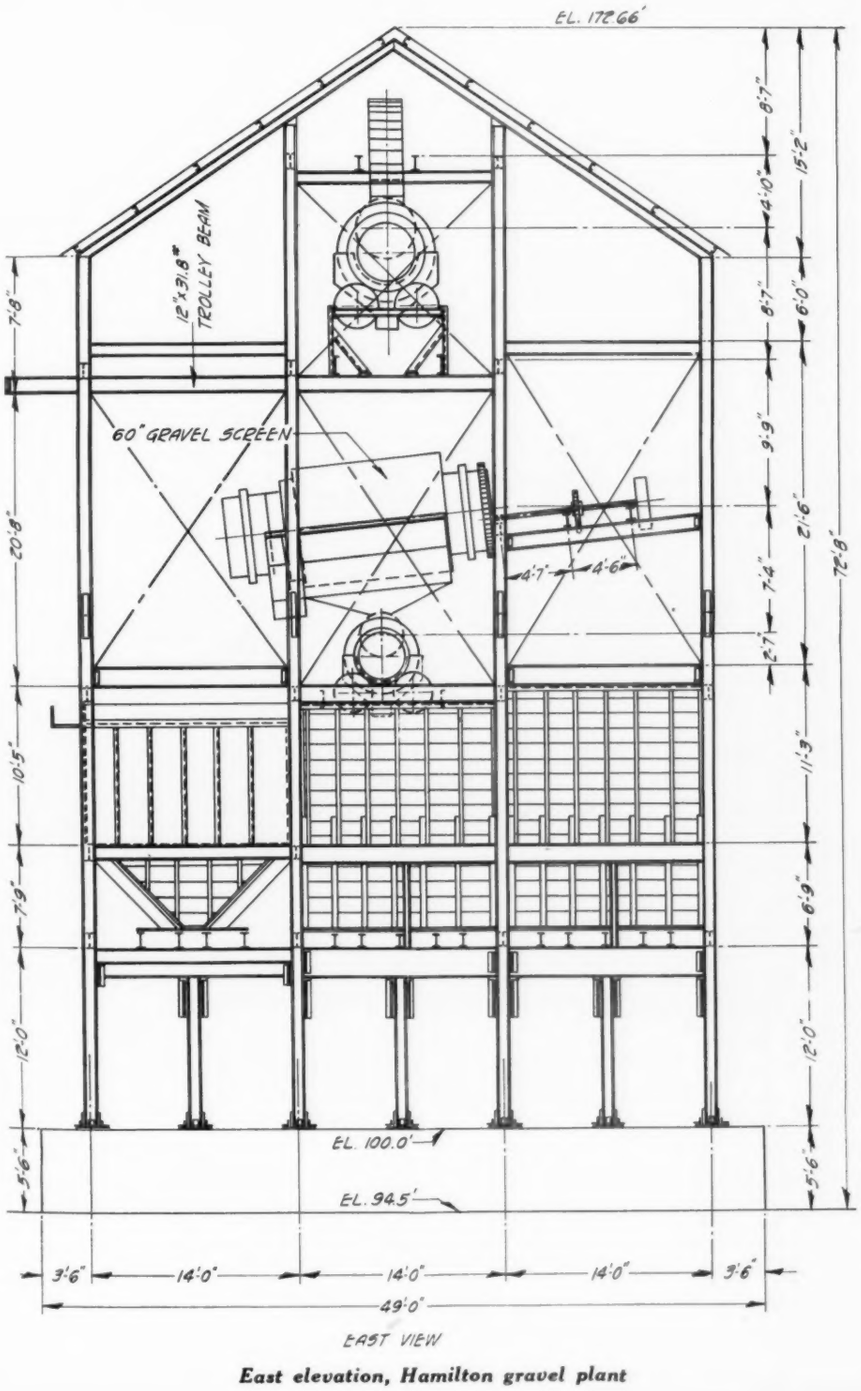
The items of equipment, when not otherwise stated, are all belted to their respective drive motors. General Electric, Westinghouse and Allis-Chalmers motors are used throughout the sand and gravel plant and the slag plant also. For details of motors and ratings see the appended motor schedule.

The sand from the ¼-in. by ¾-in. slotted sand jacket falls to a 36-in. by 14-ft. Greenville rotary sand screen having an inner barrel of ¾-in. round perforations and an outer barrel of 1/10-in. wire cloth. The sand falls to settling boxes that discharge to bins or to cars below. At the time of inspection a Greenville sand drag was being installed to further classify the sands. The sand classifier will furnish fine, sharp sand for masonry work and the different grades of concrete sand.

Slag Plant

The American Materials Corp. has also built a new slag plant adjoining the blast furnaces of the Hamilton Coke and Iron Co., Hamilton, and about 3000 ft. south of the gravel plant already described.

The Hamilton Coke and Iron Co. produces an iron of a high degree of purity, an iron that is used for the production of Armco sheet steel and plate. The molten iron from these blast furnaces is hauled to Middletown, a distance of about 10 miles, in specially constructed car ladles, heavily insulated to prevent loss of heat and consequent chilling while the metal is in transit.



East elevation, Hamilton gravel plant

At the start of operations the slag produced had a weight of 74 lb. per cu. ft., but through co-operation with the iron producer this weight has been gradually increased to 78 lb., giving a much more satisfactory aggregate material. Ordinary blast-furnace slag is said to run between 68 and 70 lb. per cu. ft. Increasing the weight of the slag was accomplished partly by stopping the practice at the furnace of lining the slag spouts with coke breeze, for the combustion gases given off by the coke gave the slag a porous structure. Instead, the operators now use slag dust supplied from the screening plant, and thereby get all the desirable results that were inherent in the coke breeze and give to the slag none of the detrimental features due to the coke.

The slag has high cementing qualities and its angular properties make it in demand for base and top courses of macadam roads. For this purpose 1¾-in. to 4-in. is used, and 2¾-in. to 1¾-in. for the upper courses, with a top dressing 1⅜-in. to ⅛-in. The material is sold for traffic-bound roads and for use as a light weight concrete aggregate.

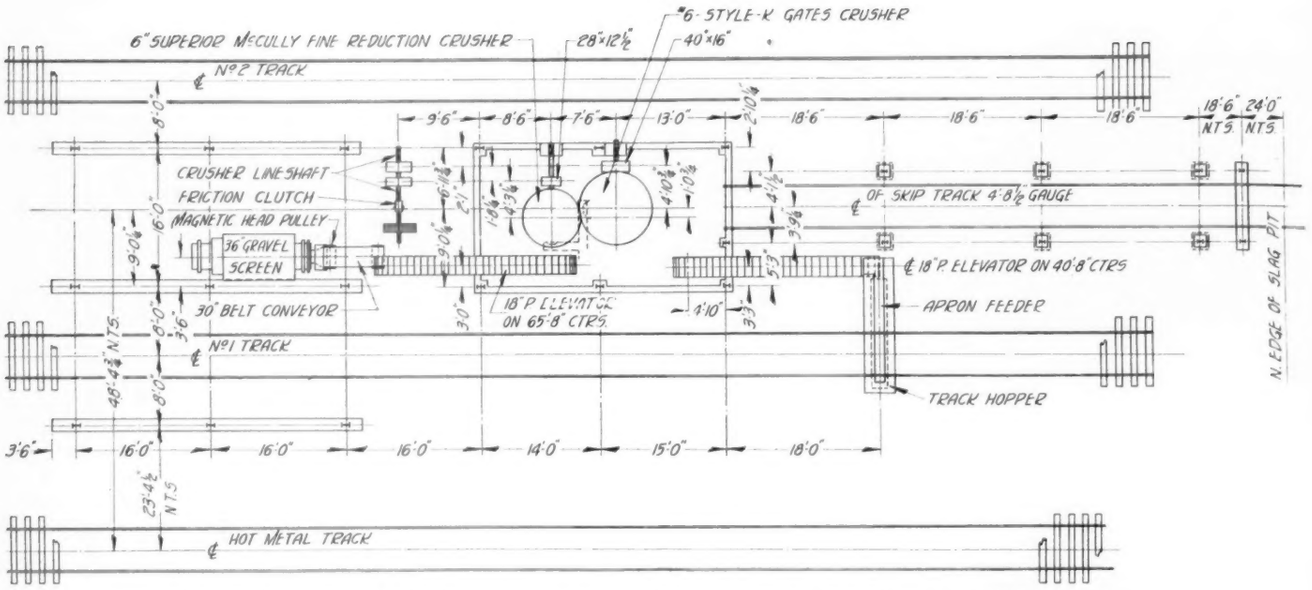
It is especially in demand for top dressing automobile parking spaces and for filling surface dressings and around gasoline filling stations, for it has an attractive appearance and is not readily picked up by automobile tires nor does it leave a track. The ⅜-in. to ⅛-in. size is also used as roofing pebble.

The slag contains no coke and 50% of the product after passing the crusher will be of the 4-in. to 1½-in. size. The material has the following chemical analysis:

SiO_2	35.30%
Al_2O_3	11.76
CaO	42.90
MgO	7.85
Fe	.45
S	.90
Mg	.67
—	.17
Total	100.00

There is considerable metallic iron in with the slag, particularly at the back end of the pits, where the molten slag first enters, so that care must be exercised in sorting out the larger pieces of metallic iron before loading. Any small pieces that get by do no damage to the primary crusher, as the crusher is set to a wide opening. Smaller pieces of iron are prevented from flowing through the entire plant by a magnetic pulley at the head end of a short belt conveyor between the primary and secondary crushers.

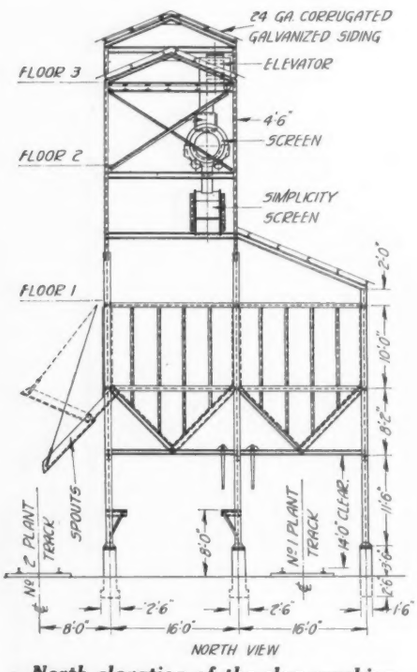
Both the slag plant and the gravel plant were designed and constructed by the engineering department of the American Mate-



General plan of the slag plant at Hamilton, Ohio, operated by the American Materials Corp.

rials Corp., and all of the screening and elevating equipment was supplied by the Greenville Manufacturing Works.

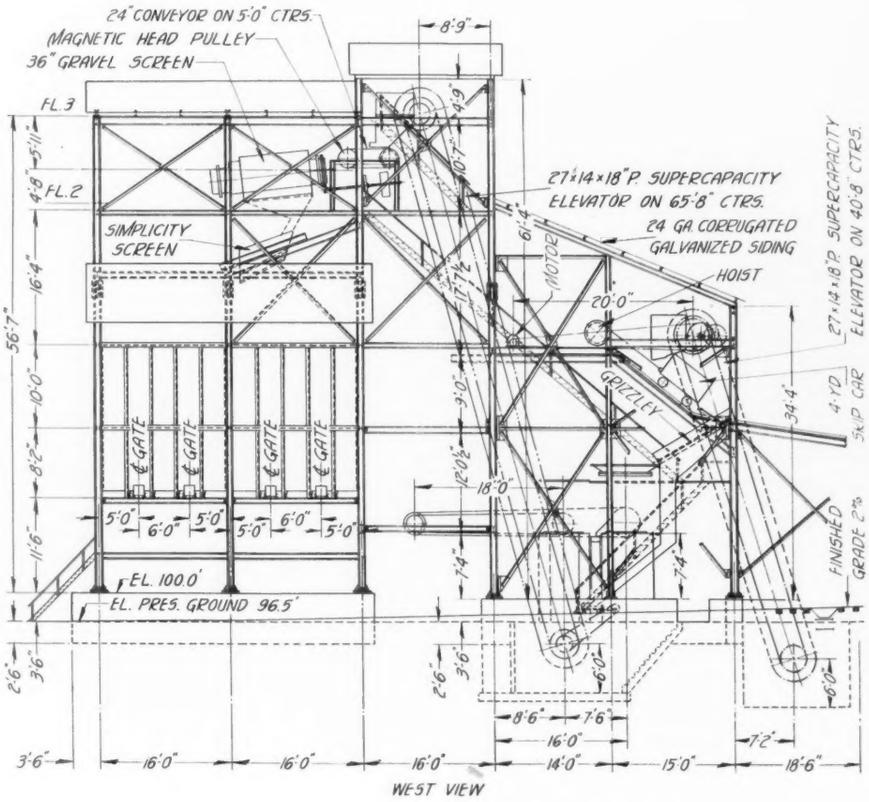
The slag from the pits is loaded by a No. 32 Marion steam shovel, mounted on crawler treads and having a 1¼-yd. bucket. The bucket has manganese steel teeth and front. The shovel discharges to a 2½-yd. skip-car running on an elevated reinforced-concrete structure. A single-drum Greenville hoist, equipped with a solenoid brake, pulls the car to the No. 6-K Gates crusher, used as a primary crusher, where the car is automatically dumped. The primary crusher is set to deliver a 4-in. product which falls to an 18-in. pitch supercapacity bucket elevator that elevates the material and discharges it to a short 42-in. belt conveyor, the head pulley of which is equipped with a Dings magnetic pulley.



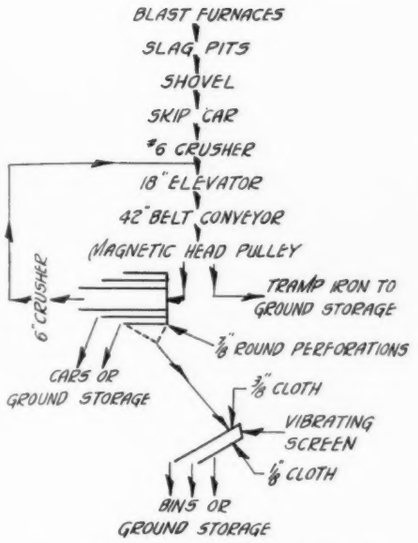
North elevation of the slag crushing plant

The magnetic pulley discharges any tramp iron to the waste bin via a steel chute and allows the slag to fall to the single 36-in. Greenville revolving screen, that has a screen jacket as well as an outer dust jacket. The total length of this screen is 18 ft. 8 in. The first 10 ft. of the inner barrel has 2¾-in. round openings and a 4-ft. over-hang section having 4-in. perforations. The middle screen jacket is 9 ft. long and has 1¾-in. perforations, while the outer jacket is 8 ft. long and has ⅞-in. round openings. The screen is driven by a 20-hp. General Electric motor through a Texrope drive.

The oversize from the end section falls to a 6-in. Superior McCully fine reduction crusher, the discharge of which falls back to the boot of the 18-in. elevator. The minus



West elevation, slag plant, showing positions of principal equipment



Flow sheet of operations at the slag plant

⅞-in. from the dust jacket falls to a double-decked, 3-ft. by 6-ft., Simplicity vibrating screen, the upper deck of which has ⅜-in. cloth and the bottom deck ⅛-in. The sized products from the rotary and Simplicity screens fall to steel bins below from which the cars or trucks can be loaded direct by gravity. The plant requires a total of seven men, five in the plant and two on storage work.

Motor Schedule*

HAMILTON, OHIO, SAND AND GRAVEL PLANT

Inclined belt to plant	Slip-ring	General Electric	50	hp.
60-in. gravel screen	Squirrel cage	General Electric	25	hp.
48-in. stone screen	Squirrel cage	General Electric	20	hp.
36-in. sand screen	Squirrel cage	General Electric	10	hp.
18-in. pitch bucket elevator	Slip-ring	General Electric	25	hp.
No. 5 crusher and No. 4 crusher and 36-in. disk crusher	Slip-ring	Westinghouse	100	hp.
8-in. pump	.....	Allis-Chalmers	100	hp.
6-in. pump	.....	Allis-Chalmers	25	hp.
Sand drag	.....	General Electric	5	hp.
12-in. pitch bucket elevator	.....	General Electric	7.5	hp.
Vibrating screen	.....	General Electric	3	hp.
Total			370.5	hp.

HAMILTON SLAG PLANT

			Drive	
Skip car	Slip-ring	G. E.	Direct-connected	25 hp.
No. 6 crusher and 6-in. crusher	Slip-ring	G. E.	Belted	85 hp.
18-in. pitch elevator and 42-in. belt conveyor	Squirrel cage	G. E.	Belted	30 hp.
Magnetic pulley generator		G. E.	Direct-connected	10 hp.
36-in. revolving screen	Ball-bearing	G. E.	Texrope	20 hp.
Vibrating screen	.....	F. E.	Belt	5 hp.
Total				175 hp.

*Power purchased. All motors on 3-phase, 60-cycle and 440-volt current.

ville Manufacturing Works. The method of stockpiling is quite common in some of the eastern crushed stone operations, but in a slag plant is a novelty.

The operation of both the Hamilton plants is in charge of Geo. D. Scheuneman.

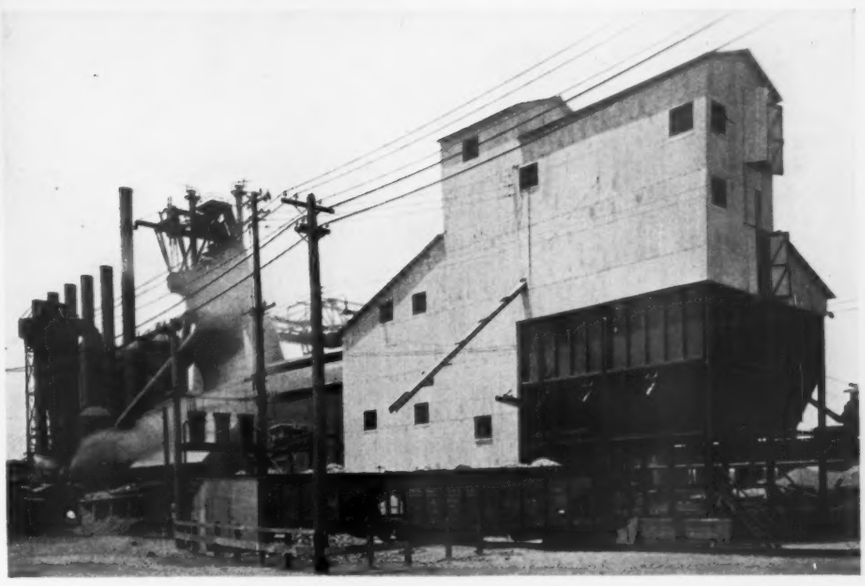
Loading slag from the cooling pit

The slag operation has an unusual method of storing excess sizes. Omort Style D, 3½-yd. motor trucks, having dual pneumatic tires, are loaded and run up on to the top of the storage pile where they are dumped. Old planking is spread across the top of the storage pile to act as a "corduroy" until the path has become sufficiently packed to withstand the traffic. The storage piles built in this manner have heights up to about 25 ft. Reclaiming is done by clamshell cranes. The Omort truck is manufactured by the Green-

Canadian Bulletin on Mica

THE Department of Mines of Canada has issued a comprehensive bulletin on mica, designated as No. 701. In the 142-page book by H. S. Spence, the writer has condensed the more important data contained in the earlier publications of the mines branch; gives a review of the present status of the mica industry in Canada, and presents the available information relating to mica and the mica industry throughout the world.

In view of the present depressed condition of mica mining in Canada, much of the data relating to individual properties, now idle, has been omitted from the present report. The book is priced at 30 cents. Address the Mines Branch at Ottawa.



The slag crushing plant is adjacent to the steel works shown at the left

General view of the Cliffe Hill quarry, near Leicestershire, England

A "Rationalised" Roadstone Quarry*

Manufacturing Roadstone by Modern English Methods at the Cliffe Hill Quarry Near Leicestershire, England

WHEREVER two or three quarry managers in England are gathered together to talk shop, sooner or later you will hear a certain quarry in Leicestershire mentioned. This is the Cliffe Hill Quarry situated in the heart of the Leicestershire granite district.

A bystander might be forgiven for thinking that this quarry had just been opened out and for that reason only, was free from the handicap of obsolescent plant, but he would be wrong. Cliffe Hill Quarry was opened out in 1890 and has steadily increased in size and resources ever since.

If it ever was true, as some people used to say, that Leicestershire was noted for its excellent roadstone and its conservative quarrying methods, then here was always an outstanding exception. The excellent granite is there certainly, but the methods of quarrying and processing the stone have been scientifically simplified constantly to such a degree that now one cannot help comparing the layout and equipment with the most modern American practice. Whether the fable about Leicestershire's conservatism was true or not, it is certainly true that Cliffe Hill have set an example in scientific production which other industries in the country beside quarrying might follow with advantage.

A typical English concrete road, approach to Gunthorpe Bridge, Notts. C. C.

Briefly, this organisation has realised that in these days of keen competition production costs must be cut to their lowest point. Since in the Leicestershire Area labour has always tended to be the main production cost, it was necessary to install machinery which was capable of taking over the breaking down of the stone, hitherto, for some markets, done by hand.

Has Country's Largest Crusher

For this purpose the largest gyratory crusher yet installed in the United Kingdom has been put into operation. The machine, an Allis-Chalmers, is capable of taking a block of stone weighing 30 cwts. Any stone not more than 2 ft. 6 in. in thickness, and of any length can be handled.

*Reprinted from *Good Roads*, January, 1930.

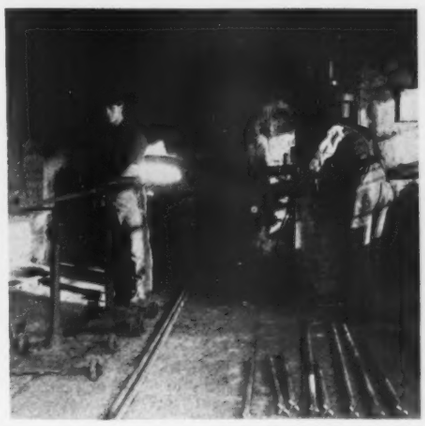
Scenes snapped in connection with the operation of the Cliffe Hill Quarry in England

Rock from the primary crusher passes over a magnetic separator to this grizzly set for 2-in. material and the oversize goes to the secondary crusher

Rock drills at work

The primary crusher is driven by a 250-hp. motor through a 14-rope drive. The rock from this "breaker" is then fed over a magnetic separator to the grizzly shown in picture at left side of page

"Setters" at work on quarry face

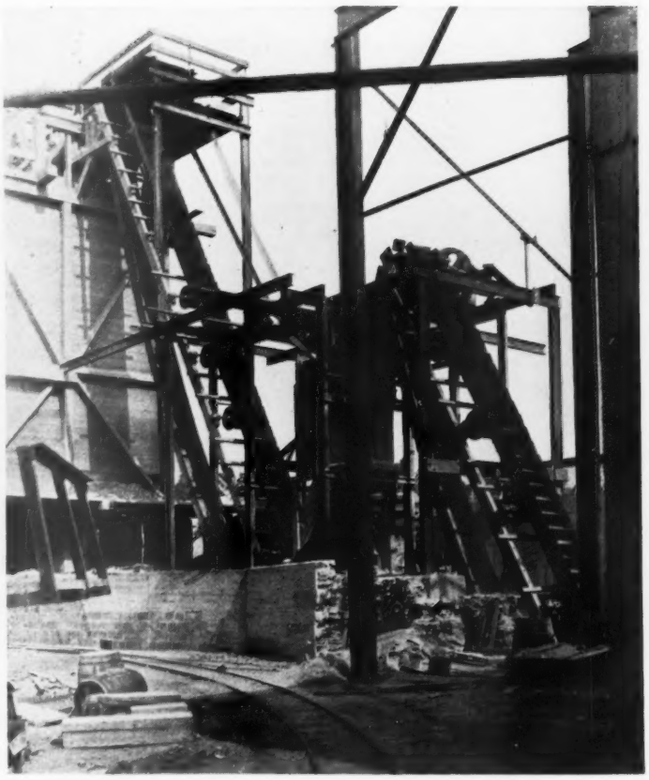


The steel sharpening shop

Material ready to be tipped into the primary crusher, said to be the largest in Great Britain, and a view of this crusher during the process of installation

This primary breaker is capable of 200 tons per hour down to 4 in., and is driven by a 250-hp. Brush motor through 14 Texropes. The material from this crusher is passed over an Igranic magnetic pulley to extricate any tramp iron, elevated and passed over an Allis-Chalmers roller grizzly which allows material up to 2 in. to pass through, and passes over the larger sizes to a 10-in. Allis-Chalmers fine reduction crusher.

Both the material which passes through the grizzly and the oversize which goes through the fine reduction crusher is fed to the same 30-in. elevator. This carries the material to a height of 80 ft. and delivers it to the largest rotary screen we have ever seen, and which must, we think, be one of the largest ever put into operation.



Conveying the crushed rock to the top of the hoppers

Develop Own Screening System

The screen is 6 ft. in diameter and 72 ft. in total length, taking out $\frac{5}{16}$-in., slots, 1 in., 1½ in., 2 in., and 2¼ in. The Cliffe Hill organisation is responsible for the development of this class of screen. It consists of 6-ft. diameter steel rings, inside which the screen plates are bolted, the rings being spaced at every 6 ft. throughout the screen.

At a similar spacing on the supporting shaft, which is 6-in. diameter in roller bearings, are the supporting and driving chain wheels. The screen is hung in ordinary short link crane chain, thus being entirely free from obstruction, and cheap to construct and maintain, and must be one of the cheapest possible screens to drive.

The sample from this plant compares very favourably with any we have seen produced from other plants.

The hoppers underneath this screen have a total capacity of 2000 tons, and are discharged through bottom gates into steel tubs.

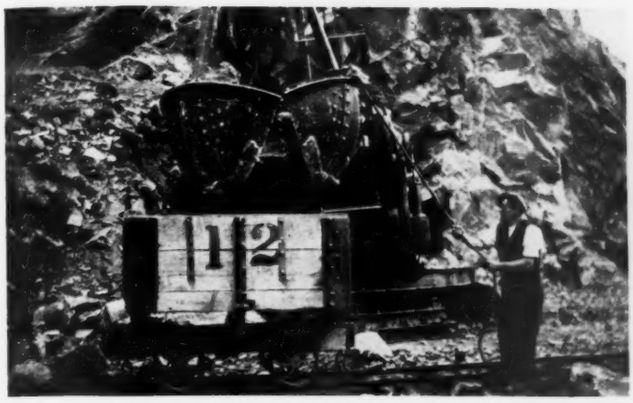
That is the main crushing and screening plant and it really is as simple as it sounds: one primary crusher, one secondary crusher, two continuous tray elevators, one rotary screen; all in a straight line: maximum potential output, 200 tons per hour.

Reduce Rock Loading Costs

Another place where labour cost has been cut tremendously in recent months is at the quarry face where hitherto rock loading had been done by hand. Although, as will be seen from the accompanying photographs, the rock is essentially massive and clean, and there is very little dirt in the ordinary sense of the word, there are some slight faults here and there.

The petrological description of the rock is Horneblende Granophyre, a coarse textured green and pink mottled compact igneous rock, almost identical with the so-called Syenite of Leicestershire. The faults mentioned seem to be due to a partial alteration of the feldspar content which results in the

This is part of the "road transport" fleet of the Cliffe Hill Granite Co., Ltd., steam and petrol "lorries" with capacities varying from 30 cwts. to 12 tons per vehicle and delivering within a radius of 50 miles of the quarries. At the right can be seen the trim administration buildings and warehouses



Orange peel "grab," shown at left, loading material from the quarry, and result of a shot

rock becoming more or less soft and unsuitable for roadstone.

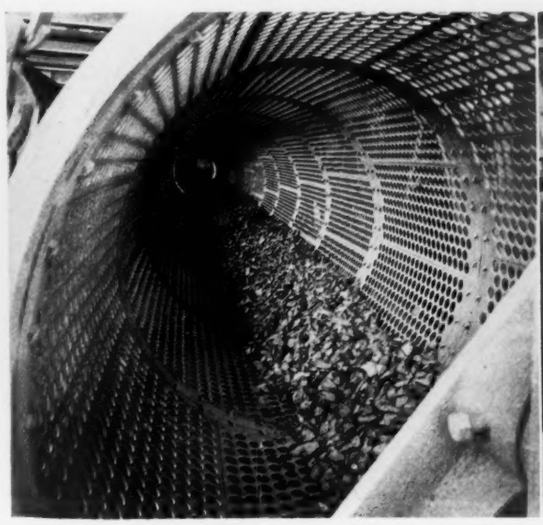
If the blasted rock were loaded by a power shovel all the soft rock would be included. It was quite a nice problem to find a way to load mechanically and, at the same time, pick the clean rock for roadstone, clearing the bad rock afterwards for separate loading and special handling.

Overcoming Loading Problem

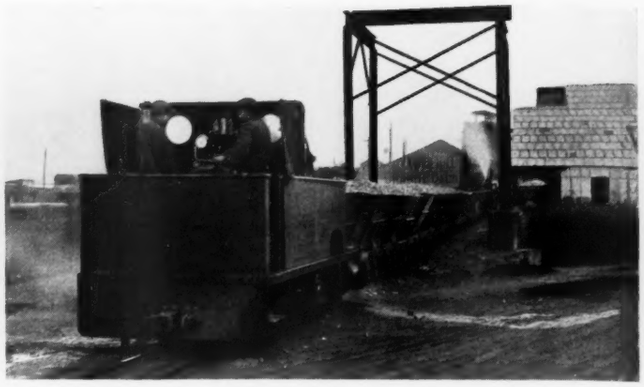
The difficulty has just been overcome by the introduction of two Haywood Tylor orange peel grabs operated by steam cranes on caterpillar tracks (Smith's of Rodley). The grabs are capable of handling a stone up to 3 tons weight and up to 6 ft. in length, and give as much power of individual selection to the operator as the hand loader would have.

After loading into side tipping tubs with a capacity of about 2 tons each, the stone is hauled by steam locomotive to the incline where the tubs are attached to the haulage rope and are drawn up in gross loads of 20 tons to the plant level by a large haulage drum driven by a 150-hp. Brush motor. The incline is one-in-three and the haulage plant is, in itself, quite an impressive piece of equipment.

Rock is hauled from the quarry by a system of steam "locos" to the bottom of the incline where the "tubs" are pulled to the plant level in gross loads of 20 tons up a 3 in 1 grade by a drum hoist



This screen is 72 ft. long and 6 ft. in diameter. The other view shows the discharge end of the primary crusher



Spoil from the quarry is carried by a 24-in. belt conveyor to a screening plant and the residue spread over a large area by the pivoted belt conveyor beyond. Picture at the right shows locomotive hauling a string of "tubs"

From the top of the incline the tubs are hauled by steam loco either to the main plant, already described, or to the old plant which adjoins it and which is now used as a standby, or to the subsidiary washing and crushing plant in the case of faulty rock, or to another subsidiary screening plant situated on the spoil heap.

Waste Is Eliminated

One of the most striking things about the Cliffe Hill Quarry is the complete elimination of waste. The faulty rock is crushed, washed and screened in a special plant which is handled by a small company of which Cliffe Hill are the parents.

This is called the Rockside Stone Co., and it handles all material which is not of first-grade quality. This material, possessing a pleasing reddish brown color, is used largely for garden path work; for filter media, and a most excellent material is marketed for hard tennis courts, and this latter, we understand, has a considerable vogue.

Another economy idea which pays handsome dividends is the spoil treatment plant, evolved after Mr. P. L. Preston, the present manager, had read in Henry Ford's *Life and Work* a dictum to the effect that the secret of success in industry is the complete elimination of waste. He asked himself if there was still any waste going on in his quarry and the next morning took a screen analysis of the dirt going over the tip.

He found it contained 40% of good stone and immediately put in a plant consisting chiefly of a 24-in. Goodyear carrier on which spoil from the quarry is dumped, a Hum-mer screen and a pivoted belt conveyor which tips the residual dirt over a wide area almost automatically.

The material which passes over the screen is returned to the plant, broken down and washed, thus providing an almost complete elimination of wastage, nothing being thrown away except the sieved dirt.

Has Natural Cubical Structure

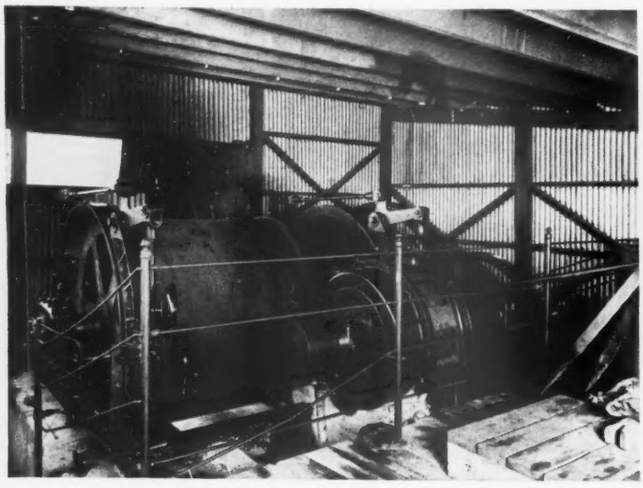
The other subsidiary plant is fed chiefly by the oversize from the big rotary screen in the main plant and turns out some of the best chippings we have seen. The stone seems to have a natural cubical structure, but even allowing for that fact it is surprising what a good cubical sample they get from this plant, the crushing unit of which is a 48-in. Symons vertical disc crusher supplied by Sandycroft, Ltd.

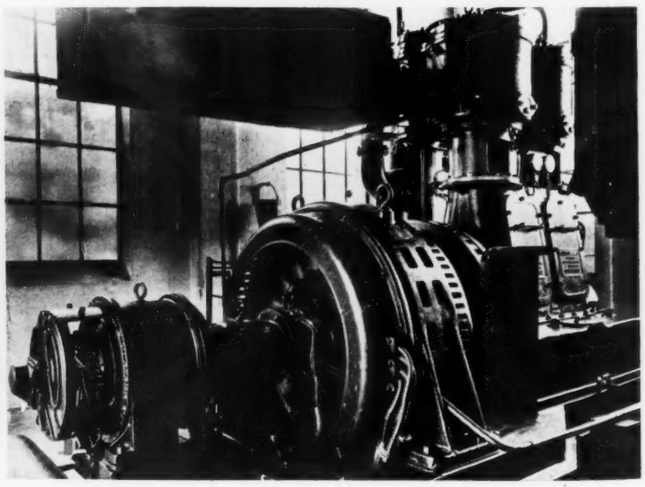
This has been at work now for three years, has turned out an enormous quantity of material, and the Cliffe Hill Granite Co. are loud in their praises of the machine. The layout of this chipping plant is of the straight line type, and in essence differs very little from the primary plant. We noticed that a Ross feeder was successfully handling the feed end of the job, and the rotary screen, this time 54 ft. in length by 6 ft. diameter, was making an adequate sample of the material fed to it. We were told that this chipping plant is capable of a steady output of 40 to 50 tons per hour.

Large Size Washing Equipment

The washing equipment at these quarries is larger than that usually installed. It consists of two elevator-fed Hardy and Padmore rotary washers, and judging from the amount of material coming through, which was being despatched as made, the company must enjoy a considerable reputation as producers of concrete aggregates.

Quarry service shops for maintenance and supplies are remarkably well equipped and organised. The compressed air mains which reach to every part of the working faces are supplied by a 1000-cu. ft. Belliss and Morcom compressor. This is driven by a 210-hp. synchronous motor, and the sight of this well-kept plant in its roomy house gives some idea of the thoroughness with which plant maintenance is carried out in these works. The compressed air drills are generally those of the Climax Rock Drill





At the left is the drum hoist which pulls the "tubs" from the quarry to the plant and, right, the 1000-cu. ft. electrically operated compressor

A view of the washing plant at the Cliffe Hill operation and the withdrawal gates under the hoppers

and Engineering Co. of Carn Brea, with an Ingersoll-Rand machine or two in the equipment. The drill steel sharpening shop is equipped with a Climax drill sharpener, and the oil-heated forge is of the company's own construction.

Maintenance and Construction

Here again considerable pains have been taken to insure a spacious and airy shop in spite of the process carried on. This desire has been successfully accomplished, as the furnace is built in a chimney, the breast of which is outside the shop. There are also spacious and well lighted blacksmiths', carpenters', fitting and machine shops, and we were informed that the company carry out the whole of their maintenance and repair work.

In connection with this it is interesting to see how complete is the maintenance equipment. Both electrical welding and oxy-acetylene welding plants are part of the kit, and the provision of compressed air and electrically-operated machinery of the portable type is unusually elaborate—more so than is the case with many general engineering shops. Even the large new plant which has been put in has been built from foundation to roof by the company's own staff, an engineering job of some considerable magnitude. The electrical equipment at these works, also carried out by their own staff, is complete.

Road Transport Publicity

The organisation and maintenance of a large and mixed fleet of road transport vehicles is, in itself, an important activity at Cliffe Hill, and the possession of these vehicles has been seized upon to afford a very effective means of publicity. If you see a Cliffe Hill lorry you can't help knowing where it comes from.

All material leaving the quarry, other than by these road vehicles are hauled a distance of 2½ miles on a 2-ft. gauge light railway to Cliffe Hill sidings situated on the L.M. & S. Railway quite near to Bardon Hill station. This line, with its gradients and curves, is most picturesque, and it is intriguing to notice the size of the locomotives employed by the company and to hear of the very considerable tonnage hauled very economically by this method. One might almost say that Cliffe Hill are light railway enthusiasts, and certainly the applicability of the light railway and light locomotives to their operations has resulted in important economies.

Concrete Block Plant

At the sidings are two processing plants: concrete and tarmacadam. Here we found concrete presses turning out hydraulically pressed concrete flags in much the same manner as cigarettes from a cigarette machine, and the figures given us of the production and sale of this commodity place the Cliffe Hill Granite Co. very high up in the scale of manufacturers. Architectural non-repetition work is also carried out to some extent, and such stereotyped lines as concrete kerb, steps, fencing posts, etc., are standardized. The tarmacadam plant, situated also at this point, is capable of dealing with approximately 200 tons per working day. A unique feature of the plant is that the driers are oil fired, giving very close control of the drying and heating of the materials. Here again it is apparent that the company during their fifteen years' experience have achieved a notable success, the records and photographs produced from the files of the company showing a more than satisfactory rate of progression in this material. These works also are completely electrically equipped, and are well maintained.

Power Supply

Electric current, by the way, is taken from public supply (a.c. 3-phase) at 11,000 volts, and stepped down to 440 volts.

To sum up, we have described the operation of a granite producing organisation which is undoubtedly in the first rank, is determined to, and we think will, preserve its paramount place amongst its competitors, and one which might well serve as an object lesson to operators desirous of progress.

Looking over an elaborate organisation like this, with its modern equipment, its efficient layout, its social and welfare work—the mess-rooms and playing fields show that the men are not regarded as mere labour units—one cannot help asking who is responsible. Mr. P. L. Preston will tell you his father (the well-known and well-loved Peter Preston, who retired a few years ago, and who was a contemporary of Mr. H. J. Grace, a prominent figure in the quarrying world), came to Cliffe Hill when it was first started in 1890 and should get a lot of the credit for its present position.

He will go on to say that all the fellows on his staff are young, keen and work like the deuce. He doesn't mention that the most revolutionary progress has been made whilst he has been in power. Perhaps this ability to lead a team, this unselfish giving of credit to his lieutenants, is the most important reason for the present position of Mr. Preston's company

Editor's Note—In editing the copy for this article very little attempt was made to blue pencil any portion of the text so that our readers might be able to enjoy the distinctly English flavor imparted by the author. We would like, however, to add that in line with the Cliffe Hill Quarry's other enterprising manufacturing and distributing activities, the company has issued its annual booklet, a most comprehensive review of its product, its varied uses, some of the prominent installations and a host of general information in the way of formulae and data, all in vest-pocket size, with sturdy cloth binding.

To an American quarry man some interesting information is revealed in the booklet. The Cliffe Hill company explains the subject of delivery under the title "Wagon Hire," and outlines the various rates for the company and railroad "wagons." Over there the railways make a charge for hauling the material and exact a separate fee for the use of the "wagon."

Gypsum Plaster in the Ceramic Industries

Abstract of a Very Comprehensive Discussion

PLASTER MANUFACTURERS have been called upon to correct troubles in their product used in the ceramic industry. Very often these troubles are of a mysterious nature, and the following abstract of a paper presented at the recent annual meeting of the American Ceramic Society, at Toronto, Ont. (published in full in the May issue of the Journal of the Society), should be of interest to the gypsum "trouble shooter." The authors are **J. E. Wiss, T. P. Camp** and **R. B. Ladoo** (of the Canadian Gypsum Co., Ltd., and the United States Gypsum Co., respectively).

Plaster, for a number of years, has been the principal material used in the forming and shaping of ceramic products. The finished products themselves do not contain plaster, since it serves only as an intermediate between the original model or pattern and the reproduction in clay. It has come to this position because of its economy, its adaptability, and because of the peculiar properties inherent in castings made from it. The value of the resultant casting to the ceramic industry generally lies in the fact that it differs from the natural mineral in that the porosity or the absorbent character, as well as the strength, can be varied to suit the will of the user.

As commercially obtained, the purity of the rock may vary from as low as 65% to over 99%, the impurities consisting of insoluble materials, such as limestone and silica or shale. It has been customary to select only the purer deposits of gypsum rock as sources of plaster for ceramic use.

In the older method of plaster manufacture the gypsum rock is heated until all of the combined water has been driven out and the resulting plaster has the chemical formula $CaSO_4$, with no water of crystallization. This type of plaster, the so-called "second settle" plaster, possesses the peculiar property of rapidly absorbing moisture from the air and reverting to the hemihydrate. Until it has aged out to the hemihydrate, it possesses the property of combining immediately with water to form the hemihydrate when it is mixed with water, with a marked increase in temperature. Gypsum which has been heated to a red heat (or "burned") to remove all of the water of crystallization has as yet found no application in the ceramic industry.

Calcined gypsum possesses the capacity to absorb water slowly out of the atmosphere. Under ordinary storage conditions, this slow absorption may go on for from 8 to 12 months before it has any deleterious effect on the plaster. The gypsum contamination, gradually formed, causes an accelerated set, raises the water-carrying capacity, and weakens the casting. Since it is inert, it acts as so much filler, which also reduces the strength of the final casting. It is for this reason that proper rotation of plaster in storage in a ceramic plant must be practiced.

Ceramic Uses

The three most important branches of the ceramic industry requiring plaster are: (A) Pottery manufacture—(1) white ware, (2) sanitary ware, (3) insulator, and (4) stoneware; (B) Structural ceramic units--(1) terra cotta and (2) special refractory shapes; and (C) Plate glass.

In the general pottery and terra cotta field, castings of plaster serve to shape the raw clay mixture, ranging from the rather dry or heavy mixtures used in "dust pressing" and terra cotta to thin slurries used in casting holiow white ware or dinnerware. In all of these uses the clay first comes into intimate contact with the plaster and receives its shape from the plaster mold. The absorption of water by the plaster subsequently fixes the shape of the clay and strengthens it by removing free water from it to a point where it can be handled without breakage or distortion. In addition, in terra cotta manufacture, plaster serves as the intermediate plastic between the artist's clay sculpturing of the ornamental work desired and the reproduction of it in plaster. This plaster reproduction in turn serves as the model around which is cast in plaster a sectional mold, which is subsequently reassembled away from the model and serves as a receptacle and a shaping mold for the terra cotta clay.

In plate glass manufacture, calcined gypsum has an entirely different function. In this industry it also serves as an intermediate. Its prime function is the formation of a perfectly level bed and the cementing of the plate glass to this bed while it is being ground and polished. The property of absorption, so desirable in the pottery and terra cotta field, is of minor importance in plate-glass plaster. The property of slight but positive expansion, which permits plaster castings to be removed from plaster molds, and which gives plaster castings their fine, clean definition, is also not wanted in plate-glass practice. The need for smooth, bubble-free texture, so important in securing long life from a ceramic ware mold, also is not important in the plate-glass polishing process. For this use a plaster is required which mixes with water with extreme ease, and in which there is no impurity which will scratch glass. In addition, the plaster must be of such nature that, after it is mixed with water, the water which is not required in holding it together can be readily removed by using dry plaster as an absorbent. In this way water can be pulled from the plaster under a plate of glass and the strength of the bed enormously increased. In addition to its ability to spread out as a liquid and to be forced into a level bed by the laying of the glass, the plaster used in plate-glass practice must possess an expansion, during setting, so small that the set plaster remains in almost molecular contact with the glass while it is being polished. This extremely close contact, which may or may not bring in a secondary effect of surface chemical reaction, is brought about by the use of hydrated lime. This, when mixed in proper quantities with the plaster, reduces the expansion during setting to a negligible amount.

Editors' Note

THIS PAPER was addressed to manufacturers of ceramic wares and in the original contains definitions and descriptions which we take it for granted gypsum producers are familiar with. Aside from these the paper is reproduced, practically complete.

It deals (1) with proper methods of mixing, laying particular emphasis on the water-to-plaster ratio; and (2) considerable attention is devoted to practical difficulties encountered in the use of plaster and to causes and remedies.

The concluding part of the paper deals with tests to determine the suitability of plaster for ceramic use.

Obviously, the producer of gypsum should know just how his plaster is used, and the causes of failure or shortcomings in the material. Only then is he in a position to know whether the fault is in the plaster itself or in the faulty use of it.

It is from this angle that the paper has been read and abstracted by a practical gypsum man—W. B. Lenhart, associate editor of ROCK PRODUCTS, a former gypsum plant superintendent, who highly commends it.—The Editors.

The bond of the bedded glass to the plaster seems to be due to this extremely intimate contact, which remains unbroken during the setting stage.

Characteristics of Ceramic Plasters and Molds or Castings

WATER-TO-PLASTER RATIO — The most vital factor affecting the quality of plaster castings made from calcined gypsum is the weight ratio between the plaster and the water used in mixing it. Variations in the amount of water affect the strength, the total absorption, the apparent expansion during setting, and the internal structure of the casting, which in turn cause variations in the rate of wear due to use, variations in the tendency to weaken when allowed to remain wet, variations in the tendency to soften when exposed to too high a temperature, and variations in the rate of absorption of water from the clay mix being used.

Plaster from a given package may be mixed with the minimum amount of water required to give a plastic mix and produce a cast which has a dry compressive strength of more than 2000 lb. per sq. in. The same plaster may be mixed with large excesses of water, and may be subsequently dried after setting into a product which would serve satisfactorily as a blackboard crayon. The amount of water may be still further increased to the point where the finished product will never harden and will be merely a mass of gypsum crystals dispersed in water in a fluid condition. Since it is of such vital importance, the effect of changing this ratio has been studied carefully. By reference to Fig. 1, showing the effect of changing this ratio, some idea may be gained as to its importance.

The cause of these variations in strength and absorption, with variations in the water used in mixing, can be readily understood when it is remembered that, in addition to the water required chemically to transform a calcined gypsum into gypsum, excesses of water over and above this are necessary in order to give the mixture sufficient plasticity or fluidity, as the case may be, so that it may be shaped as a plastic or poured into molds as a fluid. On the completion of the setting process this excess of water remains in the casting. When it is removed, by drying, the volume which it occupies is displaced by air.

As the mixing water is varied this resultant air volume also varies. The total absorption of the plaster mold varies directly with it. As this "void column" is increased the apparent density of the casting is decreased. The compressive and tensile strengths also decrease in proportion, since in any given section the number of gypsum crystals will be reduced in proportion. Likewise, when the number of gypsum crystals in any given section or on the surface of any mold is decreased by the use of more water, the active area of gypsum exposed will decrease and thus weaken the resistance of the casting to abrasion and to shock, and will increase the rate of wear of the plaster mold accordingly. When alkalis such as sodium carbonate or sodium silicate are used in the clay, the reaction which they undergo in contact with gypsum also will cause a more rapid surface wear.

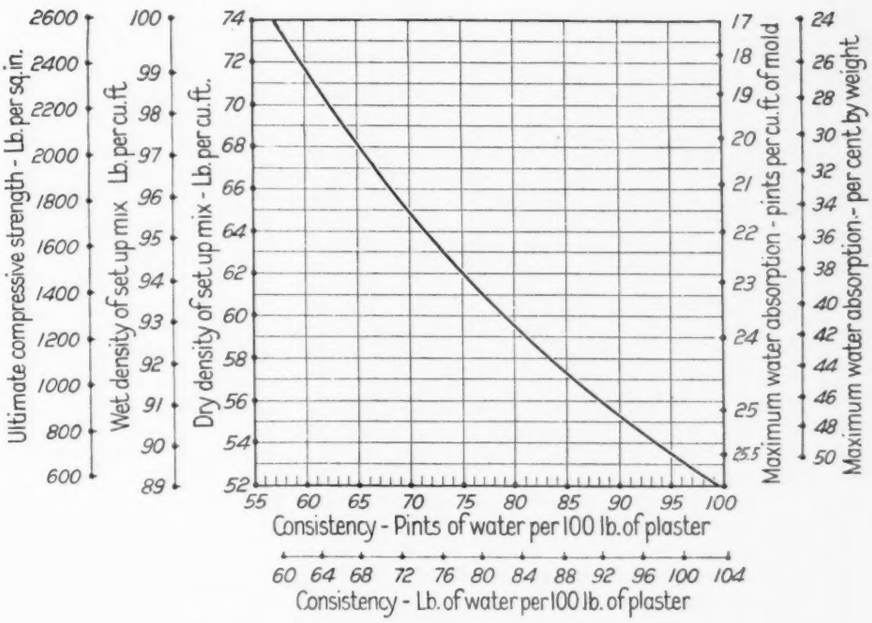


Fig. 1. Effect of changing water-to-plaster ratio

It is seldom possible to produce a workable mix of plaster and water using less than 60 lb. of water to each 100 lb. of plaster. Taking a mixture of this type for example, 100 lb. of pure plaster will require approximately 17.5 lb. of water chemically to set it completely. The mix resulting will therefore have approximately 42.5 lb. of free water in it when it has set. When the set casting is dried out it will have voids in it corresponding to the volume of 42.5 lb. of water. Reference to Fig. 1 shows that a mix at this consistency has a compressive strength of 2500 lb. per sq. in., a total absorption of 25%, expressed in weight percentage, and a dry density of 73.5 lb. per cu. ft. Mixes in common use in potteries seldom go below this figure.

This chart shows, and experience in a number of potteries and ceramic plants proves, that the least amount of water used in a plaster mix, consistent with good clean castings, will give the longest life possible.

Control of the water-to-plaster ratio is positive only when measured amounts of water and weighed amounts of plaster are used in each batch of mix. This applies regardless of whether hand mixing or machine mixing is employed. It is a vitally important factor in the production of uniformly high quality molds or castings, though it is not fully appreciated by a large number of mold makers.

Effect of Mixing on Strength

When plaster is first mixed with water, the mixture has the character of a fluid. This character slowly changes to a rather jelly-like consistency and finally hardens into the final set stage. It has been proved experimentally and practically that if mixing is continued by hand or with a mechanical mixer to the point where the plaster "draws" or begins to change from a fluid to a creamy plastic mass, the compressive strength of the casting made from this mix will be from one-fifth to one-fourth higher than the compressive strength of those made from a mix which is poured as soon as the plaster and the water are incorporated together. This means that the resistance to wear of the casting made from the first mix will be proportionally greater than that of casting from the second mix. Continuation of the mixing to the creamy state seems to give the effect of homogenizing the plastic mass, of preventing the settling which may be experienced with the plaster in its fluid condition, and thereby preventing uneven strength throughout the set plaster. It also aids in freeing the minute occluded air bubbles or pinholes, which are the final cause of failure of a large number of molds. Experience with powerful mechanical mixers, which whip large bubbles of air into the mix and which give from 10 to 15 times the efficiency of hand mixing, has shown in the ceramic and in several other related industries that the internal structure of a plaster casting may be practically freed from pinholes by following the proper technique of mixing. In hand mixes it is advisable to permit the plaster to soak or blend for several minutes before mixing in order to give the occluded air a chance to free itself from the mass. With a machine mix, the time required for soaking is only that necessary to permit the plaster to become wetted throughout. Mixers have been devised with such powerful agitation that even this time may be eliminated and the dry plaster added to the water under agitation.

When plasters are "creamed" in this fashion the resultant castings are uniform in strength throughout, they show a uniform rate of absorption over their entire surface due to the uniformity of the gypsum crystals, the strength is higher, as described and shown in Fig. 1, and the resistance to wear is the maximum which may be obtained at any given water-to-plaster ratio.

If agitation is continued beyond the point where the creamy characteristic is replaced by the "pull" or stiffening of the mix, the strength of the resulting cast may be detrimentally affected. This stiffening denotes rapid crystal formation and continued agitation is certain to break down these crystals. Maximum strength from a given water-to-plaster ratio is possible only when there is undisturbed crystal formation from a thoroughly blended mix. With extremely violent agitation, the crystals may all be broken down, resulting in a putty-like mass which has barely enough strength to hold itself together after it is dried. This condition or modifications of it, in a greater or less degree, is usually referred to as "working the mix through the set," or "killing the set." In hand-mixing operations at a low water-to-plaster ratio there is little possibility of overagitation. The hand cannot apply energy to the mixing rapidly enough to keep the crystals from forming a set mass. A high-speed, high-powered mechanical mixer, however, can completely kill the set, particularly of a high water-to-plaster ratio mix. If when the "pull" or stiffening starts more water is added and the agitation continued, the set is also "killed." Retempering, by the addition of water to a stiffened mix, is discouraged. This is well known to the average plasterer but apparently the users of ceramic plaster do not fully appreciate its importance.

Volume Changes in Plaster

EXPANSION DURING SETTING—When a calcined gypsum is mixed with water and as the resulting mixture gradually changes from a fluid or plastic into a solid, there are certain volume changes which occur simultaneously with the changes in the state of the mixture. In the preparation of plaster models and plaster molds in the ceramic field,

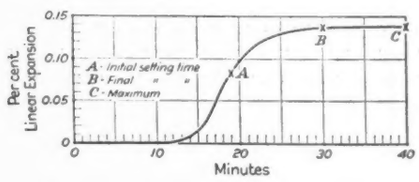


Fig. 2. Expansion during setting

the net result of the volume changes is one of slight expansion. Theoretically, as the calcined gypsum used changes its crystalline structure into gypsum during setting, the volume of the set plaster as calculated from its true specific gravity and formula weight should be less than the sum of the volume of the ingredients from which it is made. The true volume of the gypsum crystals in any casting is most certainly less than that of the plaster and water mixture.

The phenomenon of apparent expansion has never been satisfactorily explained, although careful measurements have been made of it. This apparent expansion is of the magnitude of 0.1% to 0.2% under ordinary conditions in a satisfactory plaster (see curve, Fig. 2). Expansion gives the plaster the ability to copy faithfully the fine detail of the model or a molded casting. By its slight but positive action it permits castings made in a rigid mold, and plaster molds made in a rigid case, to free themselves from the extremely close contact which the fluid plaster assumes, and thus renders easy the removal of plaster castings from plaster or other molds. It is possible by the addition of various materials, chief of which are hydrated lime and borax, to reduce this expansion to an almost negligible amount. Plasters which have been treated in this fashion are unfit for use in casting, since they show a powerful tendency to stick whenever they are poured and render the removal of a casting from a mold extremely difficult. On the other hand, plasters which are not properly made will show excessive expansion, rendering control on dimensions of castings difficult.

This characteristic expansion during setting requires a special technique in the preparation of plaster molds or plaster cases in which plaster molds are made. The expansion manifests itself in a linear expansion in all directions of approximately the same magnitude. When castings are made in a mold or case in which the expansion is not allowed free travel or movement there are two characteristic occurrences. The casting either expands in the mold in such a way that it binds and the mold must be split to remove it, or the casting, lacking free movement in all directions, will be warped toward the open side of the mold or case by the powerful force of expansion seeking relief toward the single free side. These two characteristics necessitate the preparation of plaster or other molds in such a way and such number of pieces as will give the final casting clearance for free expansion. This is accomplished by the preparation of plaster molds or cases in a number of pieces and in manufacture of large plaster molds similar to those used in terra cotta, the binding together of these molds with spring clips or with fixed bracings which will move in a lateral direction. A necessary adjunct to bracing pieced molds and spring clipping on larger work is the careful application of such surface sealers as shellac, soap, stearin, etc. Treatments of this kind have a twofold purpose: They seal the plaster case and prevent sticking of the plaster casting in it, which may be caused by the absorption of the fluid plaster into a porous spot in the case; they also lubricate the face of the case and permit free movement of the casting being made in it.

CONTRACTION DURING SETTING—In actual practice there is sometimes a contraction of the plaster used in castings. A careful study of this has shown that it occurs in the use of a very quick-setting plaster and an abnormally large amount of mixing water, which so disperses the plaster that the resultant casting is weak internally and seems to show a general volume shrinkage. In most cases studied the quick setting has been due to the use of old plaster which has been partly transformed back to gypsum, or has been due to the acceleration of the set caused by large amounts of impurities in the mixing water, by the addition of an excess of accelerating agents, or by overmixing.

THERMAL EXPANSION—In addition to these two volume changes which seem to be due to changes in the actual internal structure of the casting, during and after set, gypsum castings also show a very small coefficient of thermal expansion. Exact studies of this character have not been made. They seem to be a function of the apparent density of the casting, which in turn depends upon the amount of mixing water used. A part of the expansion noted during setting may be due to the rise in temperature which always accompanies setting, which is caused by the heat of crystallization or hydration. This slight thermal expansion is ordinarily of little moment. When molds are dried, however, in a warm drier, and then suddenly exposed to low temperature or to drafts of cold air, a surface crazing may develop. This crazing is due to the rapid initial contraction of the surface of the mold which is not followed by corresponding volume changes in the interior of the molds due to the very low thermal conductivity of the casting. The occurrence of this type of crazing due to thermal shock is quite similar to the crazing in

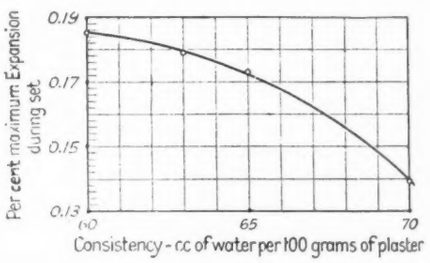


Fig. 3. Variations in mixing water and plaster

glazes on finished pottery, caused by the same type of shock.

GENERAL FACTORS—Experimental work on the expansion of plaster during setting has shown that it depends upon several variables which may be introduced in the process of mixing the plaster with water. A study of these variables and their effects shows the following results:

(*a*) Variations in mixing water-to-plaster ratio cause variations in apparent expansion during setting. As the ratio of water to

plaster in mixing is increased the expansion during setting shows a decrease (see curve, Fig. 3). As before noted, it is possible to use so much water in mixing that a shrinkage or a negative expansion may be experienced. Mixes of this type are difficult to reproduce unless complicated by quick set due to the previously mentioned reasons.

(*b*) Variations in fineness seem to produce variations in the expansion, generally speaking, the finer plaster giving the larger expansion at any given water-to-plaster ratio.

(*c*) Variations in setting time seem to cause variations in expansion, the quicker setting plaster showing the greater amount of expansion, as a general rule.

(*d*) Increases in the length of mixing time, which has a secondary effect of accelerating the set, seem to cause an increase in the total expansion.

(*e*) As a matter of experience, the expansion of any plaster and water mixture during setting seems to be somewhat a function of the apparent viscosity of the mixture as affected by mixing; in general, the thicker the appearance of the mixture the greater the total expansion.

(*f*) The age of the plaster up to the point of its stabilization as hemihydrate has an effect on the expansion. In general, the fresher the plaster the greater the magnitude of expansion. This expansion may be controlled by chemical aging in processing.

ADDED SUBSTANCES: LIME, BORAX, ETC., HAVE VARIOUS EFFECT—This characteristic of expansion has been studied in the past, and studies of the effect of the various manipulations on it are still being continued. These studies to be of value will include all of the variables noted above and they have not as yet been put into proper shape for presentation. Fortunately they are of small magnitude, and this magnitude may be held to a uniform amount by uniformity of manipulation in plaster handling practice. It may be stated that when the water-to-plaster ratio is being controlled, where the mixing time is being held uniform, and where cleanliness in mixing and proper storage of the plaster are maintained, uniform satisfactory results are obtainable, and they are being obtained in actual practice.

Setting Time of Plaster: Accelerators and Retarders

Plasters, as used in the ceramic and allied industries for general casting purposes, contain no materials for the control of the setting time. In other words, they have the normal setting time of calcined gypsum without the addition of accelerator or retarder. This setting time, when determined under standard conditions, will vary from 25 to 40 minutes for final apparent set to take place; that is, from the time the plaster is mixed with water until the time a casting may be handled without damage. This time is also subject to variations in handling the plaster, exclusive of the addition of any foreign materials which will retard or accelerate the set. Some of the factors affecting the set of a normal plaster in normal use are as follows:

TEMPERATURE DIFFERENCES—The set of a plaster-water mix is the quickest at temperatures between 95 and 105 deg. F. Above and below these temperatures the setting time is somewhat slower. The point of maximum solubility of gypsum in water lies between these temperatures.

While the difference in time of set due to temperature differences is normally small, usually being no more than two or three minutes, it is enough so that it may cause considerable trouble in a mold room where operating methods have been speeded up and where the set must be exactly uniform.

CONTAMINATION IN THE MIXING WATER—Water which contains alum, or set plaster, or any one of a large number of electrolytes in solution, may cause quick setting. In contrast to this, if the water contains organic materials or some of the organic acids, it may cause trouble with slow setting. It has been stated that water which is fit to drink is fit to mix with plaster.

ACCELERATION AND RETARDATION—The fact that a large number of materials have an effect on the set of plaster, retarding or accelerating it, as the case may be, demands scrupulous cleanliness in handling plaster mixes if a uniform setting time is to be maintained. As a general rule the addition of foreign substances is unsafe in casting practice or in mold making, because, in addition to causing variations in the set, they affect the expansion, the internal structure of the cast, the rate of expansion, and the total expansion, and they may have a serious weakening effect on the strength of the set plaster.

Except where it is absolutely necessary the use of retarders and accelerators is not recommended in ceramic practice or in general casting practice because of the difficulty of getting a uniform dispersion of the accelerating or retarding medium in the mixture. This unevenness of dispersion may lead to hard spots, uneven wear, and uneven expansion of the plaster during setting. Where necessity demands the use of these materials away from the point of manufacture the best practice is to dissolve them in water, if they are water soluble, or to suspend the finely ground material in the water used for mixing.

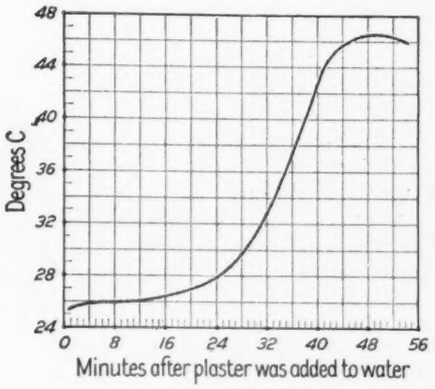


Fig. 4. Typical time temperature curve

Temperature Changes During Setting

The chemical reaction which takes place when the hemihydrate form of calcium sulphate combines with water to form the dihydrate or set-up plaster, is an exothermic one, that is, it gives off heat. In small casts with considerable surface exposed to the circulation of cool air, this temperature rise is not very noticeable. But in large casts or casts closely confined in a mold, the net change in temperature may be 30 deg. F. or more. A typical time-temperature curve is shown in Fig. 4.

In the ceramic industry the temperature rise is usually not important, but in art casting work, where glue or gelatin molds are used, it is of great importance. The temperature rise, unless carefully controlled, may result in melting or "burning" the mold. For this purpose a plaster is needed which quickly develops strength after setting, but which heats up slowly. The casting must develop strength quickly enough so that it may be removed from the mold before the heat becomes excessive.

Casting shops which use gelatin molds commonly keep ice in their mixing water during hot weather, to keep down the maximum temperature developed during the hydration process.

Drying of Plaster Molds

As has been pointed out, a plaster mold or other plaster casting, after it has set, contains part of the original water, used in mixing the calcined gypsum as free water. To develop the maximum absorbent power of the mold this free water must be removed. When any set plaster is permitted to remain undried, it slowly becomes softer and loses strength. The causes of this loss of strength are not well known, but there seems to be some change in the internal crystalline structure of the set plaster. This weakening is called "sweating" or "rotting." Similarly, if plaster molds are used for the purpose of shaping clay and are permitted to remain wet over a period of time, they gradually lose strength due to this "sweating." This gradual loss of strength is accompanied by more rapid wear of the surface of the mold and consequently shorter mold life than would normally be expected. This condition calls for some positive means of drying out the molds regularly, and it has become common practice to allow a certain period in every 24 hours for the molds to be dried out. The rate of apparent weakening of a plaster mold by "sweating" is roughly proportional to the apparent density of the mold, which in turn is a function of the water used in mixing the plaster. That is, a mold mixed with a large amount of water or made from a thin mix of plaster will appear to weaken due to "sweating" more quickly than a mold made from a heavy

mix or one using a minimum amount of water. This apparent more rapid softening of the lighter mold seems to be due to the fact that the mold has not the original strength, and therefore slight weakening is much more easily noticed.

In order to prevent this weakening, as well as to keep the molds in the proper state of porosity, artificial drying is commonly resorted to. In the best practice there is used a mangle or drier in which the temperature and the humidity of the air is under control. This calls for recording thermometers as a check on maximum temperature, control of the humidity of the air, and also calls for proper circulation of air to prevent local overheating and consequent destruction of the plaster mold due to this local overheating. This overheating, called "burning," softens the mold faces by a recalcination of the set mold back to calcined gypsum. It is evidenced by the chalky condition of the back or on the exterior of the mold, sometimes accompanied by hair-line cracking. When this hair-line cracking or softening occurs, the life of the mold is seriously reduced, in some cases the mold being unfit for use after it has been exposed to abnormally high temperature.

Because of the urge of lower production costs during the past five or ten years, mangle and drier temperatures have been increased and the speed of travel of molds and ware have been increased proportionally, in the effort to get a greater number of turns of ware from each mold out of a day's run. In a number of cases the increased yield of the equipment has more than offset the shorter mold life caused by these higher temperatures used. In other cases the speed has been obtained, but the shortening of mold life has been laid to defective plaster rather than to the changed conditions.

It has been determined experimentally and practically that as long as there is free water in a mold it will withstand temperatures up to the boiling point of water (212 deg. F.). As soon as the free water is removed, the edges and the parts of the mold exposed to this high temperature begin to recalcine. Various investigators have placed maximum drying temperatures at from 120 to 150 deg. F. Experience has shown that temperatures above 150 deg. F. maintained for several days on a dry mold are enough to cause surface failure. For this reason thermometric control and maximum operating temperatures of 150 deg. F. are advisable when the length of time in the drier may be excessive. This slow recalcination of molds described is purely a time-temperature reaction. The rate of transition from one stage to the other below this temperature, however, is so slow that under normal conditions of operations it is never met with except at extremely low relative humidities and exposure over long periods of time.

The condition of surface crazing of plaster molds has been described in the section under "Expansion." As pointed out there, it is due to thermal shock caused by bringing dry, hot molds into contact with cold air, the resultant thermal contraction on the surface in some cases being enough to crack the surface of the mold. This condition appears to occur only when the molds are dry, so that all free water has been removed from them. Generally speaking, the denser or stronger the mold, the more liable it is to surface crazing due to thermal shock.

Surface Hardness of Molds

The surfaces of plaster molds may be hardened experimentally by the use of dextrine, gum arabic, and various other colloidal substances. In practice, however, treatment of this kind reduces the rate of absorption on dry molds, and is valueless when damp, since then the hardened gum has a tendency to soften. Treatment of the plaster surfaces, whose function is that of an absorbent, with any material which will harden them, will tend to seal the absorbent surface and thus render the mold less fit for its purpose.

Various methods have been devised to determine the surface hardness of a plaster mold, in an effort to get an index of the wearing qualities of the mold. One of these methods uses a modification of the Brinell hardness tester for steel, that is, a ball pointed, weighted instrument pressed on a plane surface of plaster. The diameter of indentation into the plaster made by this spherical point under a constant pressure has been used as an index of the surface hardness. All methods are open to the objection that plaster molds which contain water are weaker than the dry molds, and that they grow still weaker on the surface either by "sweating" or by calcination when used. This means that any surface hardness testing would only be an index of the hardness of the mold under the condition of the test.

The compressive strength, the tensile strength, and the production of a mixture of plaster and water which is of uniform texture throughout seem to be the deciding factors in mold life. The strength factors are decided by the uniformity of the mix and the amount of plaster in a unit volume. Since the strength increases in proportion to increases in weight, that is, to decreases in the mixing water used, it is evident that there will be more plaster on a given area to withstand abrasion and solution in a dense mix than in a light mix, and there will be consequently slower wear in the dense mix. It is for this reason that emphasis is placed on the plaster-to-water ratio and the carefulness of mixing.

The best mold that it is possible to produce will, of course, gradually wear out. Abrasion from the clay mix will in time wear down the surface to such an extent that the additional material required in a piece of ware more than offsets the cost of a new mold. Because of the cost of the additional clay mix required, which also affects the final weight of the ware, some ceramic plants have concluded that it is cheaper in the long run not to use molds up to the point of being completely worn out, but arbitrarily to discard them after they have yielded a certain definite number of turns. This point is determined by balancing the cost of a new mold against the cost of the additional clay mix in the old mold.

Effect of Electrolytes Used in Casting Processes on Mold Life

The common electrolytes used as deflocculents for clay slips have been sodium carbonate or sodium silicate. Both of these materials react chemically with calcium sulphate forming sodium sulphate and the corresponding carbonates or silicates of calcium. The sodium sulphate is highly soluble in water and is carried through the mold to be deposited on or in the mold surface at the point of evaporation of the water during drying. Under cool conditions of relatively high humidity it is deposited as long, feathery needle crystals of Glauber's salt (sodium sulphate with 10 molecules of water of crystallization). Under the usual forced drying conditions with air at relatively low humidity, sodium sulphate is brought to the surface or in the surface as crusts which cause surface pitting and wear. It is for this reason that evaporation from the active absorbent faces of a mold should be reduced to the minimum in all molds used for slip castings.

The insoluble calcium carbonate and calcium silicate formed at the same time gradually deposit on the active face of the plaster mold. The deposition continues until at times the entire face of the mold has been transformed from plaster into these constituents. When plaster is used for this type of casting the surface deposition of calcium carbonate and silicate is the usual cause for mold failure. Sometimes it is possible by scraping to remove the surface deposits and in this way expose fresh plaster surfaces for absorption. At other times crusts of these calcium salts will flake off and cause surface pitting in the mold, sometimes sticking in the body of the ware and causing a flaw.

Recently the use of organic deflocculating agents has been started in a few plants. These materials serve the same purpose as the alkalis, and they do not have the harmful effect on the plaster mold characteristic of the alkalis. Wherever high alkali content of slip clay is now being used, with the consequent short mold life, investigation of these organic deflocculents will undoubtedly be rewarded by methods which will give increased mold life and better surface character of the finished ware.

Diagnosis and Correction of Common Troubles with Plaster Molds

The foregoing discussion of some of the characteristics of plaster and plaster molds leads us naturally to a study of the common troubles met with in the use of plaster, and methods for their prevention and control. Chief among these are the following:

PINHOLES—Plaster, being an extremely fine powder, normally carries air around the

surface of each particle. In addition, it is evident that the water removed from the gypsum particles in calcination has been displaced by air; when this finely powdered plaster is added to excesses of water, the air around each particle, as well as the air within the particle, will have a tendency to flow together into small bubbles of visible dimensions in the mix. These bubbles, if they are not removed during the blending or the mixing process, remain more or less uniformly distributed throughout the mass of the mold. When the mold is put into use, especially in pressware and terra cotta, or whenever abrasion or solution in water tends to remove the face, more and more of the small visible bubbles of the order of 1/64-in. to 1/32-in. diameter will show up. As they become prominent they gradually render the ware, being shaped in the mold, rough in surface appearance. This roughness is caused by the imprinting of the pinholes on the body of the clay. When they become numerous enough the mold must be discarded as worn out.

In those potteries where hand mixing is practiced, the custom of blending for from 2 to 5 minutes before mixing is commenced permits the pinholes to coalesce into bubbles of air large enough to be freed when the mix is later agitated. If the plaster is sifted into water and mixing begun immediately, the mass becomes plastic and offers resistance to the coalescence of the air bubbles, so that further mixing only tends to give them even distribution. After the blending has been performed, mixing by hand over a period of two to four or five minutes is necessary, and if bubbles come to the top of the plaster as scum they must be removed by skimming, otherwise they will be poured into the mold and give bubbles on the face. In making hand mixes, extreme care is required both in blending or soaking and in mixing, in order to obtain the maximum freedom from pinholes.

In machine mixing it is necessary that the plaster be wetted thoroughly, and the blending stage is not so important. This is for the reason that practically all machine mixers whip large bubbles of air into the plaster mix, and these serve to dredge the pinholes out of the mix in a manner similar to the clearing of a molten glass batch by the decomposition of part of the batch into gases which form large bubbles.

Machine mixing is being so carefully performed in some plants at the present time that pinholing in the mold body is a rare occurrence. By eliminating this condition the loss of molds due to pinholing is cut down to a minimum and the limiting life of the mold is the loss of the detail by abrasion of the clay.

Some plasters show more tendency to occlude air than others. For this reason a good ceramic plaster should be made with such careful attention to particle size that this tendency is kept to the minimum consistent with uniform texture and high strength.

Hard Spots on Mold Surfaces

Hard spots on mold surfaces may show up either as high places which do not wear down as rapidly as the rest of the mold, or as spots of slower rate of absorption than the rest of the mold, which may at times cause sticking of the clay to the mold with a consequent defective surface on the ware.

Chief among the causes of hard spots in a mold is an uneven mix, that is, a mix in which the plaster and the water have not been evenly incorporated, resulting in some sections where the set-up plaster has been mixed using less water than others. The places where less water is used will be hard and will not wear down as rapidly as the rest of the mold. At other times, hard spots may be due to pieces of set plaster scale from the mixing vessel falling into the case and being incorporated into the face of the mold when it is cast. The remedy for these conditions is proper attention to mixing and to cleanliness.

Another condition which causes hard spots on the face of the mold, particularly in terra cotta practice, results from the character of the set plaster mold. Set plaster is soluble in water to a slight degree, the solubility varying from one part to 400 parts of water to one part to 500 parts of water. This solubility is such that if the mold is dried from the face or absorbent side, the water coming out from this side will deposit in the surface of the mold the gypsum which it carries in solution. As evaporation from any surface under normal conditions is not uniform throughout, the points of greatest evaporation will become harder and denser due to this deposition of gypsum, and may finally become so dense that the rate of evaporation becomes negligible. The remedy when this occurs lies in scraping the hard spots and, wherever possible, in forcing all evaporation to take place away from the active face of the mold.

Various substances such as oil, shellac or other water-repellent materials may act to give the effect of hard spots by reducing the rate of absorption, if they happen to be splashed on the face of the mold. Soap has a similar action, since it reacts with the plaster face of the mold to form a hard soap which repels water. As a result of this water-repellence the clay shape being made in the mold may not be properly dewatered at these points, and defective ware may result. When plaster molds are cast in plaster cases, the water-repellent action of soap is used to prevent sticking of the plaster casting by absorption and consequent crystallization of the mold to the case. The absorptive action of plaster on clay is just the opposite, that is, as the plaster draws the water from clay the clay pulls away from the plaster. If the absorption does not take place the clay remains in intimate contact with the plaster and cannot be successfully removed.

Cracking of Molds

As outlined in the section covering "Expansion" and the section on "Drying," there are several types of mold cracking, exclusive of the failure due to mechanical shock. These are:

(*a*) Surface crazing due to thermal shock by exposing hot molds to cold drafts of air. This type of crazing is accompanied by no noticeable softening of the plaster surface.

(*b*) Surface crazing or cracking due to recalcination caused by drying at excessively high temperatures. This type of surface cracking is usually accompanied by a very noticeable softening or tendency to become chalky. It may sometimes occur on the same molds which show crazing due to thermal shock, because of the high temperatures reached during recalcination.

(*c*) Where iron or other metal which will corrode and expand is present as reinforcement in the mold, the mold life may be shortened by the expansive action of the products of corrosion. This condition takes months to occur and usually does not show up, since the molds wear out from use. Where molds with metallic reinforcement are used the corrosion due to the action of water on the metal may be retarded by using oiled or painted metal or wooden reinforcement, although this latter does not give the same reinforcing value as metallic members. Molds which are reinforced with metal stripping which may corrode should be kept in a dry place, as the metal will not rust in the absence of water.

There is another type of cracking, which is rarely met with, caused by the differential expansion resulting from the pouring of a thick mix of plaster on a thin mix which has not been properly roughened and has gone into its initial set. When this type of expansion occurs, it occurs during or immediately after the set of the plaster, and may be recognized at once. It has only been observed in large molds where heavy metallic reinforcing was used.

Expansion Difficulties

The thermal expansion of a plaster mold and the slight expansion and contraction noted when the mold is wetted and dried, are usually of such magnitude that they may be neglected. The expansion during set, dependent on the thickness of the mix, may cause serious difficulties if not properly provided for, as described in the section under "Volume Changes." When a mold of any length greater than 3 ft. is cast against a rough surface, the ends of the molds should be so clamped that the expansion which occurs will either have free clearance or will be taken up in a slight deformation over the entire face of the mold.

The best assurance against warping or swelling troubles due to this characteristic expansion lies in maintaining a constant plaster-to-water ratio and a constant mixing time. This is particularly true if more than one mix is being poured into a case. Where

this occurs, the heavier mix will take the greater expansion and may put a negative warp into the resultant mold or casting if it is not properly braced, whereas if the same proportions are used for each mix the tendency to warp will not be so great.

Differential expansion or warping may occur in the casting of large monolithic slabs which contain metal reinforcing, unless this reinforcing is placed midway between the opposite faces of the slab. When too close to one face, expansion of the metal, caused by the temperature rise in the plaster during setting, is counteracted by unusual thicknesses of plaster, and warping occurs toward the weaker side.

Determination of Consistency and Time of Set

A 50-gram sample is used in making this test. Since the consistency is expressed in cubic centimeters of water per 100 grams of plaster, the water measurement for 50 grams of plaster is multiplied by two in order to get the consistency.

About 85% of the estimated amount of water is placed in a small casserole or round-bottomed glass beaker. The first estimate of water needed is made roughly by adding water to a 50-gram sample until it comes to fluidity and can be poured. The 50-gram sample of plaster is sifted, not dumped, into the water and allowed to soak for one minute. Sufficient additional water is then slowly added until the plaster is wetted and just covered. The mix is agitated moderately, not whipped, with a small spatula for 15 seconds and then poured from a height of 3 to 4 in. on a thin, smooth glass plate. If mixed at normal consistency the mass on the plate will spread out into a circular patty about $\frac{5}{16}$ to $\frac{3}{8}$ in. thick and $3\frac{1}{2}$ in. in diameter. A second test is then made, using the amount of water determined in the first test as the starting amount, sifting the plaster in, and mixing as described. If the patty formed is the same as the first in fluidity and spread, the test is complete and no further work is necessary. If the mass is too fluid and pours out too readily, forming a larger pat, further tests must be made, reducing the water slightly each time until the correct size of the patty is obtained. The time of set is pronounced at the time when the patty will support the large size (1-lb.) Gilmore needle with no difference of indentation on successive trials made at 1-minute intervals. The time of set is measured from the time the plaster is added to the water. The indentation method of using the Gilmore needle is preferred, since some plasters may be of such high normal consistency that even when set they will not support the needle without indentation.

Fineness

In addition to the screen testing, comparative determinations as to the amount of ultra fines or "flour," finer than the finest mesh testing screen, are made by the use of various wet and dry bulk tests. In pottery plaster and other plasters where smoothness of texture and freedom from pinholes are required, a comparison for pinholes is made against a standard sample using a section of wet plaster being examined for comparison against a section of standard.

Wash tests with water are of very little value, since the plaster goes into solution; wash tests with other materials in which plaster is insoluble have never come into favor. It is probable that air-separation methods which have in recent years been carefully studied will be applied to plaster if their value can be proved.

Compressive and Tensile Strength Determination

In making determinations of compressive and tensile strength the methods outlined by the American Society for Testing Materials are used. The plaster is mixed to normal consistency with water and 2x4-in. cylinders are cast for compressive strength determinations. Standard briquets exactly 1 in. in cross-section are cast for the tensile strength determination. The tests are performed on the specimens only after they have been dried to constant weight. Strength determinations made on plaster specimens carrying a small percentage of free water show very little more strength than the original wet casting. This wet strength is generally from one-third to one-half the ultimate dry compressive or tensile strength.

Paper Bags as Shipping Containers

PAPER BAGS are being widely used as shipping containers, since they possess the desirable features of strength, non-sifting of contents, water and vermin resistance, and economy. The most common type is the multiple-wall bag, composed of kraft paper made water resistant by rosin sizing, and having a self-closing valve through which the material is introduced. This type of bag is in extensive use for cement and other similar materials, and has proved economical not only in respect to its cost, but also in respect to breakage and protection of the contents.

There is considerable interest in the possibility of extending the use of bags of this type to other materials which must be well protected from moisture. Difficulties have been experienced with substances which absorb water readily, such as quicklime and sugar. In long shipments or in storage, quicklime absorbs sufficient moisture from the air to burst the bag through the swelling of the lime. From the same cause, sugar sometimes becomes so lumpy as to have its sales value considerably decreased. On the other hand, in many chemical preparations and food products the avoidance of loss of moisture is desired. For these purposes the ordinary type of bag has proved unsatisfactory, as it is not sufficiently impervious to air.

Recent tests of sheathing papers indicated that there are papers available which are sufficiently impervious to air and which have the other necessary qualifications for bag use, such as strength, flexibility, water resistance, and lack of odor. The results of tests of these papers were reported in Bureau of Standards *Journal of Research*, Vol. 3, No. 1, p. 75; July, 1929 (Research Paper No. 85, price 5 cents, from the Superintendent of Documents, Government Printing Office, Washington, D. C.). Two of these papers appear to be particularly suitable. One, designated in the publication as 2 L, is made of three plies of oiled kraft paper cemented together with two layers of asphalt. The other, designated 8 L, is made of two plies of kraft, with an inner ply of zinc foil, all cemented together with asphalt. Paper of the latter type costs about twice as much as that of the type first mentioned, but is practically impervious to air.

Other considerations of importance are strength and means of sealing the bags so as to have air-tight joints. Tests of the air-tightness of bags could be made by exposing bags filled with quicklime or other hygroscopic material to a moisture-saturated atmosphere. For testing walls and ends an impervious container filled with hygroscopic material, and provided with an open end and means for fastening on a diaphragm of the material to be tested, could be used. Change of weight per unit time would give the desired measurement rapidly. Strength could be determined by the "drop test" which is commonly applied by dropping filled bags until they burst, and noting the number of drops the bag withstands. There should be no difficulty in meeting all strength requirements, as papers reinforced by textile fabrics are available if required.

Research along the lines indicated would no doubt result in the development of more satisfactory containers for a wide variety of materials. The potential savings that could be effected are considerable.—*Technical News Bulletin* of the U. S. Bureau of Standards.

Kansas River Damages Sand Plant

THE SUDDEN, unheralded rise of the Blue river Thursday night sent the Kansas river up in a hurry. No notice of a rise being received, the Wamego Sand Co. was caught unprepared.

The pipe line from the barge to the bank was fouled with drift and one float was carried away. In cutting the drift away two sections of pipe were ruined. The float was found two miles west of St. Marys.

Considerable new equipment has been placed this spring, electric lights are to be installed and the plant will do considerable pumping at night. By the time the river is down sufficient for pumping the plant will be ready to go on a 24-hour basis.—*Wamego* (Kan.) *Register.*

Objective of National Crushed Stone Association's Tests

Stated to Be Method of Designing Concrete Taking Into Account the Aggregate's Characteristics—An Abstract and Review

By Edmund Shaw
Contributing Editor, Rock Products

DURING THE PAST TWO YEARS, A. T. Goldbeck, director of the Bureau of Engineering of the National Crushed Stone Association, has carried out a number of tests on the compressive and flexural strengths of concretes made from different aggregates. These have attracted wide attention, part of which was due to the fact that gravel and crushed-stone aggregates were directly compared. Much was read into the conclusions drawn from these tests by those seeking competitive sales arguments. The *primary* purpose, as all who carefully read the reports could see, was not to compare types of aggregate, but to find some method of designing concrete by which the effects of the characteristics of the aggregate used would be taken into account. In his latest report, "Some Researches and Their Practical Application," published in the March issue of the *Crushed Stone Journal*, Goldbeck announces that he has developed such a method of design and explains and illustrates its use by a number of examples.

Regarding the purpose of this and the previously reported tests, Goldbeck states: "It was not at all the object of these tests, as some readers seemed to think, to compare crushed stone as a class with material which is classified as gravel, for it always has been recognized by the writer that under both of these general classifications are aggregates which differ widely in their characteristics. Both include materials of high and also of poor quality." The results of the tests just reported no less than those of the previous tests and such others as those of the Bureau of Public Roads on type of aggregate, show that this is true—one of the fundamental truths of concrete design, but one which has too often been overlooked.

Summarizing the results of the earlier tests, Goldbeck's present paper points out that the first series was made by using the arbitrary proportions 1:2:3½, and that the single conclusion drawn from it was that such a method of proportioning was wasteful of cement and unfair to the type of aggregate used; and, hence, while the results were enlightening, such a method of making concrete could not be recommended.

It was noticeable that in these first tests much more cement had to be used with some aggregates than with others, because these aggregates had higher void percentages, a condition due to their angular shapes. In the second series of tests a uniform cement content was the starting point, 6.3 bags per cubic yard. The amount of aggregates used was obtained by Talbot's formula, $\frac{b}{b_0}=0.775$. This series gave higher compressive and flexural strengths, even where the cement content was about the same as in the previous tests (with one exception) due, one may infer, from a better proportioning of fine aggregate to coarse aggregate. But there were still wide differences in compressive and flexural strength, and the paper says that where such differences in aggregates exist the indications are strong that "it is necessary to redesign the concrete with more cement in the mixture to compensate for the deficiency in strength produced by the weak particles or by lack of bond between the mortar and the coarse aggregate."

Goldbeck has based his method of design given in the third (or present) paper on the water-cement ratio. In the previous reports it was shown conclusively that the water-cement ratio had no consistent relation to flexural strength when using various aggregates. In other words, the characteristics of the aggregates outweighed large differences in the water-cement ratio in concrete designed either by arbitrary proportions or by Talbot's formula. It will be remembered that the same conclusion was reached in Kellerman's report on the Bureau of Public Roads' tests. In Mr. Goldbeck's second series (using the Talbot formula) it was shown that a water-cement ratio higher by 0.07 might be used with angular aggregates than with smooth and rounded aggre-

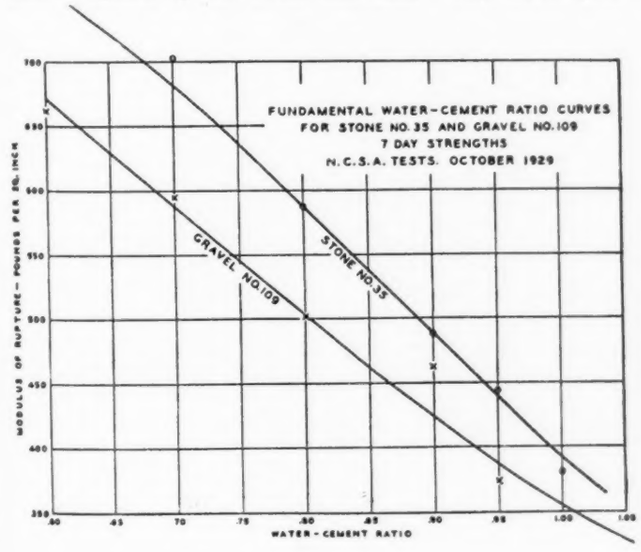

FUNDAMENTAL WATER-CEMENT RATIO CURVES
FOR STONE NO. 35 AND GRAVEL NO. 109
7 DAY STRENGTHS
N.C.S.A. TESTS. OCTOBER 1929
GRAVEL NO. 109
STONE NO. 35
MODULUS OF RUPTURE — POUNDS PER SQ. INCH
WATER-CEMENT RATIO

Fig. 1

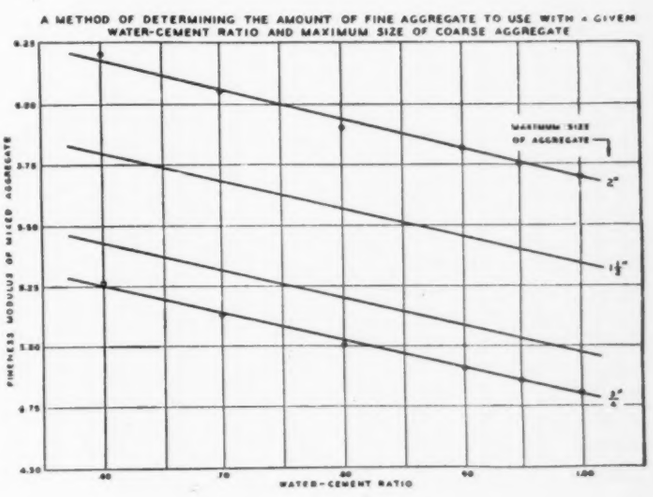

A METHOD OF DETERMINING THE AMOUNT OF FINE AGGREGATE TO USE WITH A GIVEN WATER-CEMENT RATIO AND MAXIMUM SIZE OF COARSE AGGREGATE
MAXIMUM SIZE OF AGGREGATE
FINENESS MODULUS OF MIXED AGGREGATE
WATER-CEMENT RATIO

Fig. 2

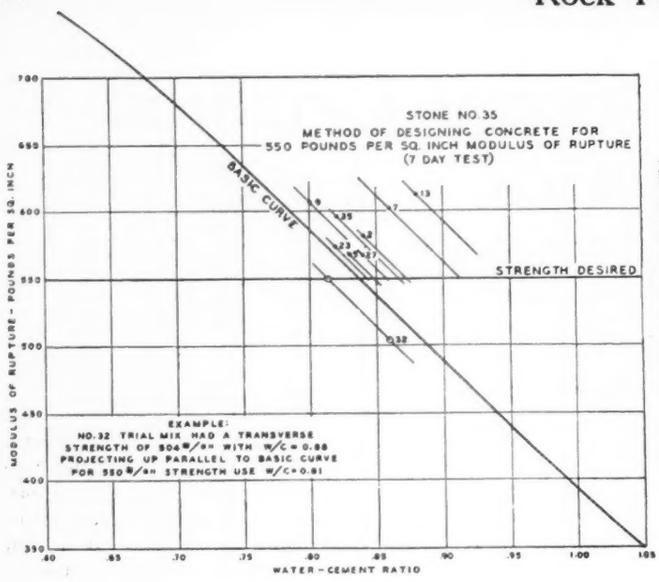

STONE NO. 35
METHOD OF DESIGNING CONCRETE FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE
(7 DAY TEST)
BASIC CURVE
STRENGTH DESIRED
EXAMPLE:
NO. 32 TRIAL MIX HAD A TRANSVERSE
STRENGTH OF 504 #/in² WITH W/C = 0.88
PROJECTING UP PARALLEL TO BASIC CURVE
FOR 550 #/in² STRENGTH USE W/C = 0.81
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
WATER-CEMENT RATIO

Fig. 3

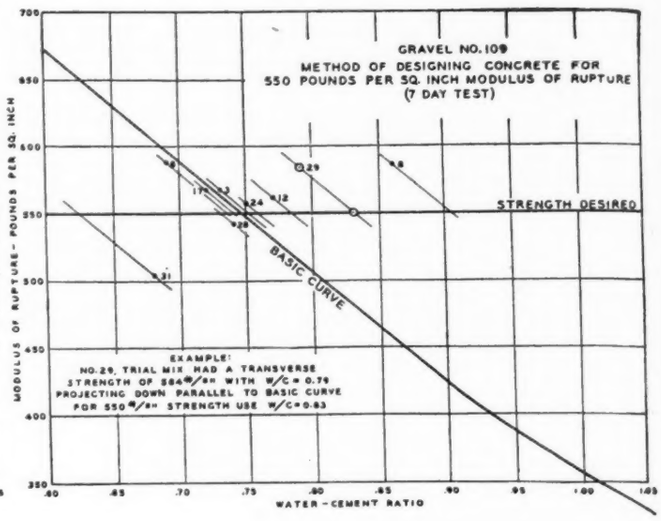

GRAVEL NO. 109
METHOD OF DESIGNING CONCRETE FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE
(7 DAY TEST)
STRENGTH DESIRED
BASIC CURVE
EXAMPLE:
NO. 29, TRIAL MIX HAD A TRANSVERSE
STRENGTH OF 564 #/in² WITH W/C = 0.79
PROJECTING DOWN PARALLEL TO BASIC CURVE
FOR 550 #/in² STRENGTH USE W/C = 0.83
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
WATER-CEMENT RATIO

Fig. 4

gates for the same compressive strength. But using an individual aggregate the strength of the resulting concrete was found to follow the water-cement ratio closely, as has been found by many investigators. It is accepted by many authorities as the fundamental cause of differences in strength. Goldbeck explains the relationship of water-cement ratio and strength as follows:

"By stating that there is a law involving compressive strength and water-cement ratio is not equivalent to saying that the relation of strength to water-ratio for all aggregates may be represented by a single curve, for this is not the case. But a series of curves, each one representing the water-cement law for concrete containing particular aggregates, will be more or less parallel, and in many cases will be quite close to one another."

In designing for flexural strength with different aggregates, Goldbeck states: "It was assumed that if there is a relationship between compressive strength and water-cement ratio for given aggregates, it should also be possible to express a relationship between modulus of rupture (flexural strength) and water-cement ratio." (Such a relation had been shown to exist by Gonnerman and Schurman, and it is very clearly shown in Walker and Proudley's recent tests with gravel aggregates.) "Accordingly, one of the first steps in the third part of the investigation was to determine the shape of the modulus-of-rupture-water-cement ratio curves for two aggregates, one a crushed stone and the other a siliceous gravel. The curves showing this relation are given in Fig. 1. It was proposed to use these curves to determine the proper proportions to use with various coarse aggregates by the following procedure:

"*(a)* Making trial batches of concrete with these coarse aggregates, using an assumed water-cement ratio.

"*(b)* Making strength tests to determine the strength of these trial batches.

"*(c)* Plotting the values for modulus of rupture thus obtained and through the points thus plotted drawing independent water-cement-ratio-modulus-of-rupture curves parallel with the curves shown in Fig. 1.

"Our coarse aggregates, as before stated, were of widely varying characteristics and widely different gradations."

The proportioning of fine aggregate to coarse aggregate was made by the use of trial batches, the consistency of the cement paste and the sand content being so regulated "that identical workabilities were obtained in all cases, according to the judgment of the operators, supplemented by flow tests." Six batches were made from 2-in. maximum size stone using a wide range of water-cement ratios and the same procedure was adopted with a ¾-in. siliceous gravel. The results are given in the top and bottom curves of Fig. 2, the curves for 1-in. and 1½-in. being established by interpolation.

The curves in Fig. 2 were found useful in finding how much sand to use in the mix. Although Goldbeck does not say so directly, one may assume that after the water-cement ratio had been decided upon the starting point for a trial mix was the proportion of fine and coarse that gave the fineness modulus corresponding to the water-cement ratio chosen, for the quantity of sand (r) to be used was obtained by the formula:

$$r = \frac{m_c - m}{m_c - m_f},$$

in which r is the sand required, m the finness modulus of the mixture required and m_c and m_f are the fineness moduli of the coarse and fine aggregates, respectively. Trial batches were made up and tested and the results are shown graphically for crushed stone in Fig. 3 and for gravel in Fig. 4. The wide spread in the flexural strengths of gravel concretes shown in Fig. 4 is particularly noticeable, but it is not so surprising if one recalls the wide variations in percentage of wear and some other characteristics that were given in the first of these reports.

A strength of 550 lb. at the end of 7 days was sought for and the test results given in Table III show how closely this result was approximated by the 7-day strength of the samples. Graphically the results are shown in Figs. 5 and 7. Fig. 6 gives the economic value of the various aggregates for flexural strength only, that is the flexural strength compared with the bags of cement used.

The paper gives in brief form the steps which are taken in this method of designing for flexural strength:

No.	W/C	Flow	Bags Cement per Cu. Yd.	Proportions Dry, Loose Volume			Modulus of Rupture lb. per sq. in.		Crushing Strength lb. per sq. in.	
				Cement	Sand	C.A.	7-day	28-day	7-day	28-day
2	.87	165	5.45	1	2.60	3.54	571	689	2850	4130
3	.69	160	6.69	1	1.74	2.94	555	668	3820	5660
5	.85	166	5.83	1	2.46	3.41	514	672	2430	4270
6	.72	169	6.57	1	1.78	2.84	553	619	3240	4710
7	.85	164	5.60	1	2.41	3.46	505	707	2890	4440
8	.85	164	5.24	1	2.48	3.57	523	702	2630	4270
9	.85	164	5.50	1	2.18	3.75	559	644	2980	3920
12	.77	165	6.49	1	2.11	2.64	557	659	2940	4670
13	.84	167	5.81	1	2.43	3.19	591	744	3130	4400
17	.73	174	6.46	1	2.00	2.74	590	703	3100	4830
23	.84	156	5.63	1	2.24	3.57	515	727	2540	4360
24	.75	165	5.82	1	2.04	3.51	544	725	2990	4680
27	.87	159	5.44	1	2.38	3.74	530	741	2720	4060
28	.72	167	6.71	1	1.76	2.64	544	673	3390	4990
29	.80	164	5.55	1	2.32	3.38	517	688	2560	4260
31	.60	174	8.60	1	1.20	2.02	516	643	3980	4970
32	.82	169	5.93	1	2.22	3.19	535	733	2830	4540
35	.87	162	5.17	1	2.50	4.10	509	684	2300	3840

Table III

"1. Establish the water-cement-ratio-modulus-of-rupture curve for typical crushed stones and gravels expected to be used (Fig. 1).

"2. With the fine and coarse aggregates proposed for use, make up a trial batch of concrete with an assumed water-cement ratio using a ratio of fine to coarse determined from Fig. 2.

"3. At the desired test period, obtain the modulus of rupture of the concrete.

"4. Plot the result and through it draw a water-cement-ratio-modulus-of-rupture curve parallel to the basic curve (Figs. 3 and 4).

"5. Where this curve, for the given materials, crosses a horizontal line representing the desired strength, read off the necessary water-cement ratio.

"6. Make up a new trial batch using this water-cement ratio and determine the proportions by well known laboratory methods."

Discussing the test results, Goldbeck says:

"In the first place, it is to be noted that the crushed-stone concretes have as high cross-breaking strengths as the gravel concretes notwithstanding the fact that they almost universally have a much higher water-cement ratio. It is also plain that the crushed-stone concretes have attained as high a 7-day beam strength as the gravel concretes, or practically so, with a smaller cement content. There are some exceptions to this rule particularly where the gravel contains crushed and calcareous fragments.

"There is still another fact of interest, namely, that at 28 days the crushed fragment concretes seem to have gained more strength than the concretes containing rounded fragments. Perhaps this is due either to a somewhat better bond or somewhat greater strength of the fragments.

"These statements are not intended to convey the impression that in all cases crushed-stone concrete may have a higher water-cement ratio and a lower cement content than gravel concrete for that may not be the universal rule. Nevertheless there seems to be a general tendency in that direction and probably that will be the more usual condition with exceptions here and there.

"The outstanding fact is, however, that the method here presented permits of the design of concrete which will have approximately the same cross-bending resistance. This is a most important fact in connection with concrete pavement design. Incidentally, it is pointed out that the crushed-stone concretes, having a higher water-cement ratio and a lower cement factor, also have somewhat lower compressive strengths than the gravel concretes, when their values for modulus-of-rupture are about alike. For concrete pavement design this is unimportant, for pavements do not fail by crushing; they fail by lack of beam strength.

"In Fig. 8 is shown the percentage of increase of modulus of rupture of the various concretes at 28 days as compared with 7 days. In some cases the crushed stone has gained strength in greater proportion than the gravel concretes, and in other cases the reverse is true, but it seems as if the angular coarse aggregates in this series show a greater tendency to gain beam strength than the rounded fragments."

Comment on the Tests

The necessity of a method of designing concrete for a definite flexural strength has been recognized for some time and the concrete and aggregate committees of the American Society for Testing Materials have been working on such a method for the past year. The method developed by Goldbeck described in the paper abstracted appears to be thoroughly satisfactory judging by the results obtained with aggregates varying widely in characteristics and properties.

The method is based on well established principles, and it follows what might be called the standard method of designing concrete for compressive strength. This method makes use of Abrams' curve (the curve "A" of the Portland Cement Association's pamphlets) and establishes a "job" curve paralleling it with the materials that are to be used. From the job curve are taken the water-cement ratios to be used and the proportioning of the materials for workability is done by making trial mixtures.

In the place of Abrams' curve, or Curve "A," Goldbeck establishes the curves shown in Fig. 1 as general or fundamental curves showing the relation between water-cement ratio and flexural strength. Then curves for each aggregate are established correspond-

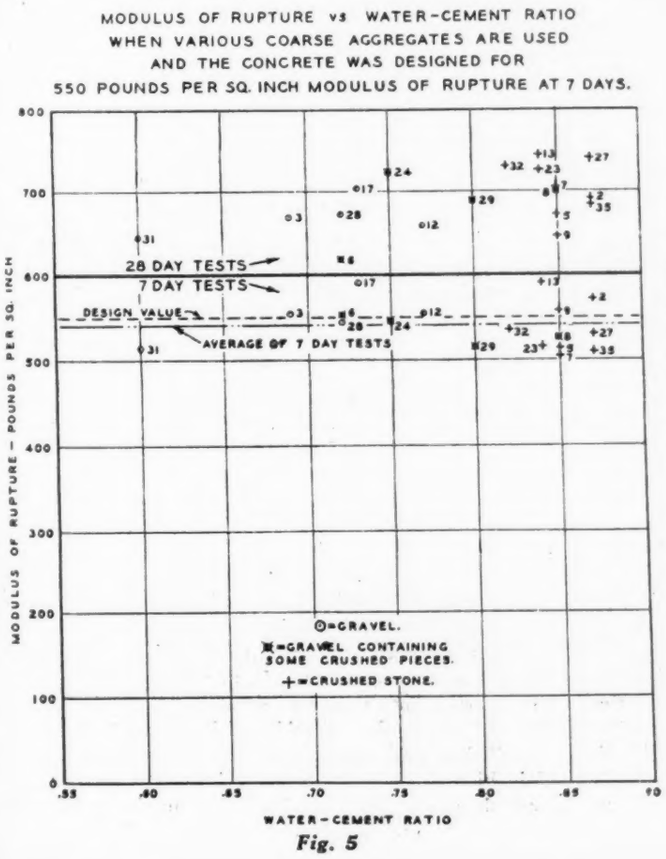

MODULUS OF RUPTURE vs WATER-CEMENT RATIO
WHEN VARIOUS COARSE AGGREGATES ARE USED
AND THE CONCRETE WAS DESIGNED FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE AT 7 DAYS.
28 DAY TESTS
7 DAY TESTS
DESIGN VALUE
AVERAGE OF 7 DAY TESTS
⊙=GRAVEL.
✕=GRAVEL CONTAINING SOME CRUSHED PIECES.
+=CRUSHED STONE.
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
WATER-CEMENT RATIO

Fig. 5

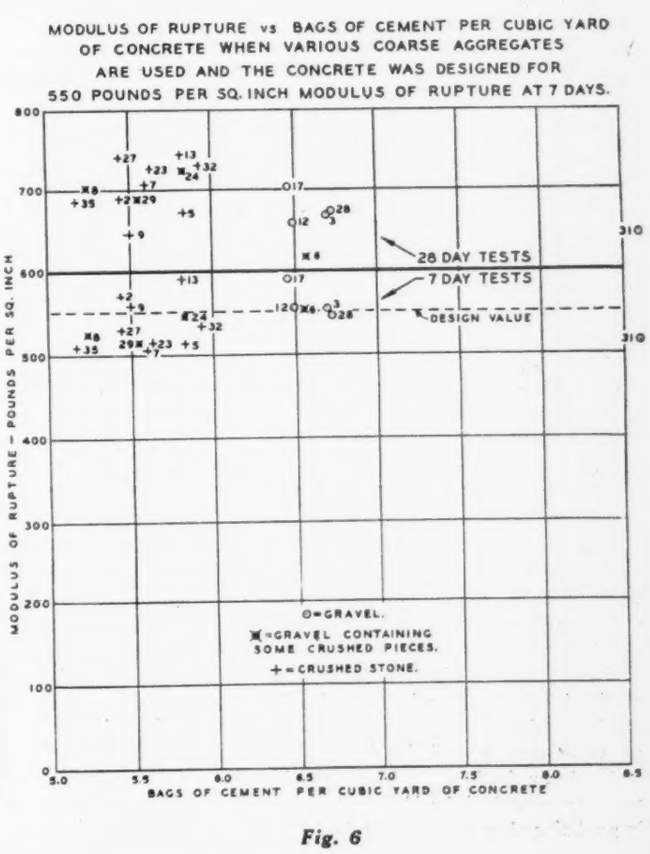

MODULUS OF RUPTURE vs BAGS OF CEMENT PER CUBIC YARD
OF CONCRETE WHEN VARIOUS COARSE AGGREGATES
ARE USED AND THE CONCRETE WAS DESIGNED FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE AT 7 DAYS.
28 DAY TESTS
7 DAY TESTS
DESIGN VALUE
⊙=GRAVEL.
✕=GRAVEL CONTAINING SOME CRUSHED PIECES.
+=CRUSHED STONE.
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
BAGS OF CEMENT PER CUBIC YARD OF CONCRETE

Fig. 6

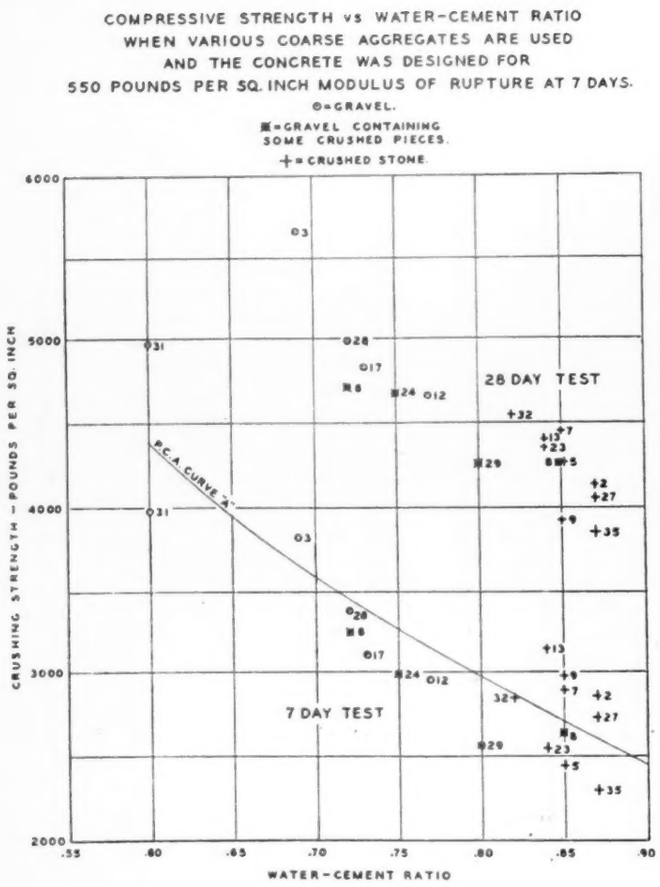

COMPRESSIVE STRENGTH vs WATER-CEMENT RATIO
WHEN VARIOUS COARSE AGGREGATES ARE USED
AND THE CONCRETE WAS DESIGNED FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE AT 7 DAYS.
⊙=GRAVEL.
▣=GRAVEL CONTAINING SOME CRUSHED PIECES.
+=CRUSHED STONE.
CRUSHING STRENGTH - POUNDS PER SQ. INCH
WATER-CEMENT RATIO
28 DAY TEST
7 DAY TEST
P.C.A. CURVE "A"

Fig. 7

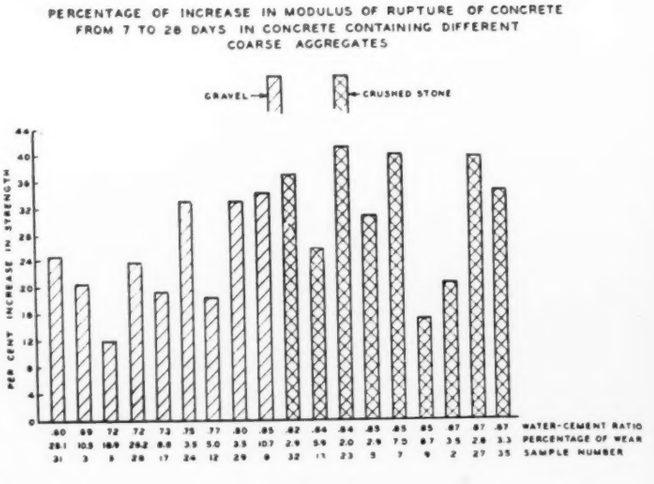

PERCENTAGE OF INCREASE IN MODULUS OF RUPTURE OF CONCRETE FROM 7 TO 28 DAYS IN CONCRETE CONTAINING DIFFERENT COARSE AGGREGATES
GRAVEL
CRUSHED STONE
PER CENT INCREASE IN STRENGTH
WATER-CEMENT RATIO
PERCENTAGE OF WEAR
SAMPLE NUMBER

Fig. 8

ing to the job curves used in designing for compressive strength. These are shown in Figs. 3 and 4. The remainder of the procedure is using the water-cement ratio corresponding to the required strength found on these curves with trial mixtures, just as in designing for compresive strength.

It is the writer's opinion that a single basic curve might have been established for the aggregates used regardless of whether they were stone or gravel. While the gravel and stone curves are not parallel in the figure they are nearly so and the "scatter" of the points from which they are drawn is such that a single curve would not be much farther from any point than some of the distances in Fig. 1. If the purpose of the paper is to develop a method applicable to all aggregates, regardless of type, there seems to be no reason for developing curves for different types.

As a comparison between types of aggregate these tests prove no more than those which have preceded them. There are so many variables present that one cannot say *definitely* that angularity or roughness of surface had any considerable influence in the result. There was a wide variation in the maximum size of the aggregates tested and the effect of such variation in size is strikingly shown in Fig. 2. The gradation of the aggregates varied widely and differences in gradation alone may account for 15% or so in strength, according to studies that go back to the days of Fuller's curve. And at least three of the gravels tested showed such a high percentage of wear that one would say at once that their structural strength was insufficient to permit them to be used where flexural strength was wanted. But these same gravels would be quite satisfactory where only compressive strength was wanted. These characteristics of the aggregates used may be found in the tables given in the report of the first of Goldbeck's tests.

Sand and Gravel for Filter Beds

BRITISH EXPERIENCE in both the filtration of public water supplies and of sewage is much longer and more comprehensive than American experience. Hence the following editorial from our British contemporary, *The Contract Journal*, may prove interesting and helpful to sand and gravel producers:

"It is important that the sand grains in a filter bed shall not be disintegrated by the water with which they are constantly in contact. For this reason a good filter sand should be of high silica content. To insure durability of the sand grains, it is generally required that not more than 5% shall go into solution in hydrochloric acid after 24 hours digestion, or that the sand consist of at least 95% silica. Most specifications also limit the amount of calcium and magnesium carbonate. The upper limit varies in the different specifications, but it is generally not more than 2%. Some of the specifications place limits on iron, alumina, alkalies, loss of ignition, etc., but most of them do not include these detailed requirements.

"Gravel is used in filters for water purification and also in the treatment of sewage. In water purification the purpose of the gravel is to serve as a base for the filter sand and to permit complete and rapid drainage of the filter. The size and grading, therefore, while important, can be varied over a considerable range. The gravel base is usually prepared in several different layers, each made up of one size of gravel, with the coarsest material on the bottom and the finest material in contact with the sand. The same precautions with respect to disintegration of the gravel particles by the water must be exercised as described under filter sands. A common requirement is that the unpulverized gravel shall not contain more than 5% of material soluble in hydrochloric acid.

"Gravel, while not so commonly used in filtration of sewage, has all the characteristics necessary to such operation. The function of a filtering material in a sewage filter is essentially that of a lodging place for bacteria which gather and grow upon the surface of the stones and by the life process effect a reduction in the bacteria and organic content of the sewage. In general, the filtering material should present a maximum of surface area, a moderate resistance to passage of the liquid, and a comparatively rough surface. The surface must not be so rough as to prevent the necessary sloughing of the colloidal jelly which coats the particles and which disgorges periodically, and it must not be so smooth that it is not capable of holding a health growth of the jelly-like substance. It is also important that the material used in sewage filters resist frost action and the action of the sewage with which it comes in contact. Any particles which disintegrate tend to clog the bed and thereby reduce its efficiency. Stone for sewage filter beds, therefore, must possess a high degree of durability. The size of the particles should be fairly uniform. No general conclusions seem to have been reached as to the sizes which are most efficient. Present practice seems to favor material graded from about 1 in. to 2½ in."

Raw material being taken from the Muskingum River, screened and crushed, then spouted to tow barges

Unique Sand and Gravel Dredging Operation

Floating Screening and Crushing Plant Works with Separate Dredge Unit

THE Muskingum River Gravel Co. has been improving its truck-loading plant at Zanesville, Ohio, by replacing the old bins with six new bins of substantial construction with steel floor beams and hardwood floors and sides. The new bins will have a capacity of about 700 tons, and a Simplicity vibrating screen will be installed over them for additional washing of certain sizes. A 20-ton Fairbanks-Morse platform scale will be installed to replace the present scale used for weighing trucks.

The truck loading bins are kept filled by an American Terry derrick located alongside and equipped with a Lidgerwood electric hoist and 2-yd. Blaw-Knox clamshell bucket, which also serves to unload the screened sand and gravel from the tow scows to the storage piles on the wharf from which the bins are filled. The site is also served by two railroad sidings for rail shipments, one alongside the bins and the other along the edge of the wharf. The material is used for road materials and concrete aggregates.

Unique Dredging Plant

The raw material is taken from the Muskingum River by two different dredging units, where it is screened and crushed as desired, and spouted or conveyed to the tow barges which are then moved by two stern wheel type gasoline-engine-driven tug boats to the Zanesville loading plant, or to such other shore points as may be desired. Twelve wood tow scows of about 150 to 200 tons capacity and one steel tow scow of 400 tons capacity are used. For unloading at the shore points other than the main loading plant a steel hull derrick boat with Lidgerwood steam hoist and 85-ft. boom and 1¾-yd. Blaw-Knox clamshell bucket is used.

The dredging units are of two entirely different types, each with a capacity of about 1000 tons per 12 hours depending on the nature of the digging, and operated with 6 men as described later.

One is of the side-ladder digger type with 4-cu. ft. buckets about 3½ ft. apart (2 links at 21-in. pitch) and digging at the rate of 9 buckets per minute. The chain and buckets are of manganese steel. The buckets discharge to a 4-ft. by 14-ft. Galland-Henning revolving screen with one jacket and with jets for washing. The oversize from the screen is carried back on a 24-in. belt conveyor to a 3-ft. Symons cone crusher, and the crushed material is carried up on a 14-in. bucket elevator to a 27-in. by 6-ft. double-deck Simplicity vibrating screen with 1-in. (or 1¾-in.) wire cloth on the upper deck and ¼-in. cloth on the lower deck and with jets for washing. The screened and washed material is conveyed over to the scow alongside. This unit is steam driven.

The other unit is known as the screen boat and is rather unusual and interesting. It does not do any digging but is served by a derrick boat with an American Hoist and Derrick Co. steam hoist, a 70-ft. boom, and a 1½-yd. Blaw-Knox clamshell bucket, which excavates the material from the bottom of the river. The clamshell empties on an inclined grizzly screen and hopper on the upper deck of the screen boat, the hopper being covered by rails spaced 5 in. apart so that oversize material goes back into the river. The hopper discharges to a 4-ft. by 16-ft. revolving screen with one jacket and jets for washing, and is arranged with a gate to control the feed to the screen. This screen has a 5⅛-in. diameter shaft, mounted on Dodge-Timken roller bearings. The oversize from the screen is carried up on a 24-in. belt conveyor to a 3-ft. Symons cone crusher and the recrushed material back on another 24-in. belt conveyor to a 3-ft. by 6-ft., double-deck, Simplicity vibrating screen. This screen is in closed circuit with the crusher. The gravel from both the revolving and the vibrating screens goes to a wash box and is scooped up by a slow moving 2-cu. ft. bucket elevator which empties into a loading spout to the tow scow alongside. The elevators and rotary screen were manufactured by the Goodman Engine and Machine Co., Pittsburgh, Penn. The

sand is handled in much the same way by another elevator.

Equipment Is Interesting

This unit is also interesting as being driven by a 120-hp. 8½x10½-in., 500 r.p.m. Fairbanks-Morse Diesel engine through a Cutler-Hammer magnetic clutch, and because the revolving screen and lineshafting are mounted on Timken roller bearings. A Falk flexible coupling is used at the Symons crusher so that it may easily be disconnected when desired, but the arrangement is such that 100% crushed gravel may be produced when desired. This equipment is mounted on a 26-ft. by 100-ft. by 6½-ft. steel hull drawing 4½ ft. The crew necessary to operate the plant consists of 6 men, 2 on the derrick boat, 4 on the screen boat, and the capacity is 600 to 1200 tons per shift of 12 hours, depending on the class of material handled.

The Muskingum River Gravel Co. has offices in Zanesville, Ohio. G. B. Bebout is president; H. D. Stillion is secretary and general manager, and J. S. Sneeden is vice-president and superintendent. The plant was designed by G. B. Bebout and J. S. Sneeden.

Railroad Box Car with Haydite Concrete Floor

A PARTY of some 60 representatives of more than 25 railroads, and others interested, were guests of the Universal Atlas Cement Co. on a trip to its Buffington, Ind., plant May 22, 1930, to see a new type of railroad car having a concrete floor instead of the usual wooden floor.

The party was taken in special busses from the company's offices at 208 South La Salle St., to the plant, where the car was inspected, and after a luncheon served in the plant's dining room an interesting trip was made through the cement plant before returning to the city.

This particular car, U P C X 971, is a steel box car of standard dimensions, 40 ft. 6 in. long inside by 8 ft. 6 in. wide, which has been in service for some time at one of the company's plants in eastern Pennsylvania, and is at present being used in the Chicago district.

Last January a concrete floor with Haydite as the aggregate was put in to replace the previous wooden floor, and the company has found that it has a number of advantages over wood for the shipping of cement either in bags or in bulk.

Most bulk shipments are unloaded with a power shovel or scraper similar to a grain shovel, which operates much better over the smooth concrete floor than over the ordinary wooden floor.

Also in the case of shipments in bags there is less danger of breakage of the bags than with the wooden floor, which is usually more or less uneven and is liable to have nails projecting. Other advantages are permanence and the ease of cleaning, as well as greater strength. An interesting fact in this connection is that this car was in a runaway and smashup last March, which was sufficient to shear off the king pin of one truck and displace the truck, but the concrete floor showed no cracks or other ill effects from this.

The mixture used in putting in the floor consisted of one sack of cement to 2 cu. ft. of coarse Haydite and 2 cu. ft. of fine Haydite, no sand or other ingredients being used. It was put in 4 in. thick, resting on the steel frame but not anchored to it, and in one piece, but with expansion joints and asphaltic fillers around all four sides between the floor and the car sides. Round ⅜-in. reinforcing bars spaced 6 in. apart and running in both directions were placed ¾ in. from the bottom, with wire mesh reinforcing weighing 21 lb. per 100 sq. ft. near the top. The weight of the 4-in. floor made of Haydite concrete is about 36 lb. per sq. ft., or approximately 12,000 lb. for the whole floor. Because of using Haydite as the aggregate this weight is about two-thirds that of ordinary concrete, while the strength is ample for the purpose. The design is good for a uniformly distributed load of 500 lb. per sq. ft. Haydite, as is well known, is made by burning shale by a patented process in rotary kilns, so that the resulting product is hard and porous and has a weight about two-thirds that of other aggregates.

The total cost of putting in this floor was stated to be about 35 cents per sq. ft. or about $120 per car.

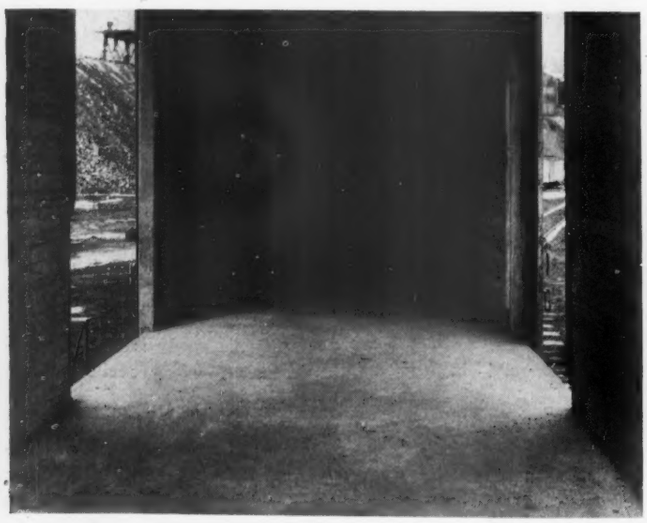
In view of the fact that the 4-in. floor showed no ill effects from the smashup mentioned, the company expects in the near future to equip another car with a 3-in. floor with the same bottom reinforcing, which will reduce the weight to approximately 9000 lb.

The objections to this type of floor from the standpoint of the railroads are principally the additional weight as compared with the usual wooden floor, and the less nailability, since automobile shipments as well as a number of others require the fastening of cleats to the car floor.

Although Haydite concrete as used in the building industry, because of its porous structure, lends itself to a certain amount of nailing, nails are not driven as readily as in wooden floors. Hence it would not seem to be as well adapted as the wooden floor for cars used in such shipments.

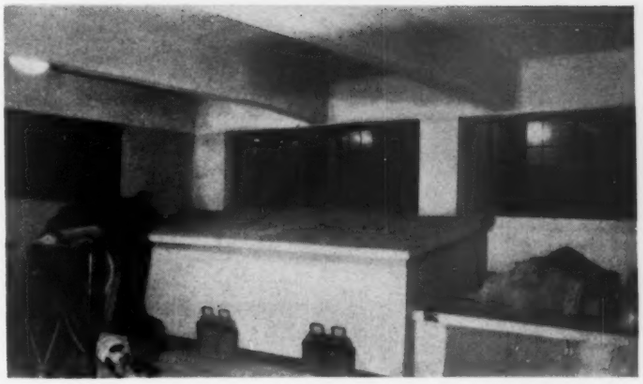
However, for such commodities as cement and for other bulk shipments it would seem to have a number of advantages, such as permanence and strength. Another possible advantage would seem to lie in the superior insulating qualities of the Haydite concrete, which is about four times that of ordinary concrete, so that its use might be extended to bottoms of refrigerator and other cars.

The various features of the car were explained by Frank E. Guy, traffic manager of the Universal Atlas Cement Co., and by O. H. Grosswein, director of technical research.



Interior view of the concrete-floored railroad car and a picture of part of the official inspection party at the Universal Atlas plant, Buffington, Ind.

Laboratory and office building



Rock bins, concrete mixer and ball mill in the laboratory

Modern Cement Testing Laboratory

Of the Southwestern Portland Cement Company at El Paso, Texas

(Contributed)

THE ONLY EXCUSE for burdening the readers of ROCK PRODUCTS with this brief description and illustrations of the new Southwestern Portland Cement Co.'s laboratory, is that several new and novel features were incorporated in the design of the building and the equipment; no expense or care was spared to make conditions ideal for making and testing cement.

Checking Disagreeable Noise

All grinding machines are equipped with individual motors and Texrope drives, the motors were especially built to give the required machine r.p.m., they operate noiselessly and with a minimum of care. All machine bearings and vibrating parts are cushioned on lead supports in an effort to cut down noise and jar.

The Tyler "Rotap" sifter is an efficient labor saver, but is disagreeably noisy in the open. To overcome this condition the Rotap is placed in a cabinet lined with celotex, and the Rotap itself rests on a lead cushion, with the result that only a faintly muffled sound is heard while the Rotap is pounding away.

Three large concrete bins, containing easily accessible rock and sand for making concrete cylinders, are located within the building, with a concrete mixer and weighing scales adjacent to the bins. The rock, or sand, is unloaded from vehicles on the outside by means of chutes.

Bench tops in the physical testing laboratory are made of quarter-inch, non-rusting, copper-bearing steel plate; the projecting edges of these plates are turned down, and the plate is held in place by means of screws and bolts with countersunk heads.

During storage of test pieces the specifications allow a tolerance of 5 deg. F. above or below 70 deg. F., making a difference of 10 deg. F. between maximum and minimum allowed. This is sufficient to cause appreciable variations in setting and strength tests, but even this range, lenient as it appears, is difficult to attain with the inadequate means of temperature control of many moist closets, storage tanks, and storage rooms, with the result that, summer temperatures and breaks are usually high, while winter temperatures and breaks are usually low.

Well-Controlled Moist Room

The moist room was designed fully appreciating the need of maintaining practically a constant temperature at all times in order to obtain representative tests from test pieces.

Exterior of the moist room

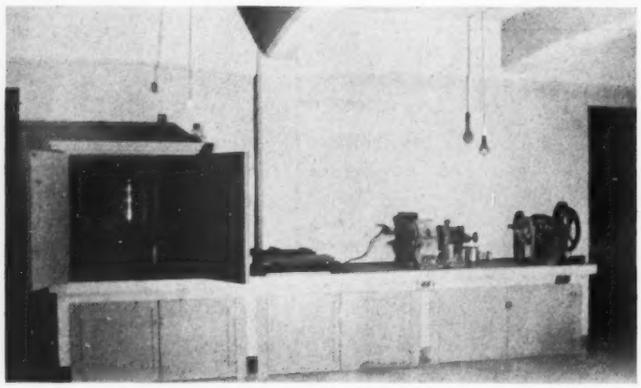
The moist room has double concrete walls separated by an insulating layer of tarred corkboard. The room has one large door for entrance, and two small window height doors to allow one to reach within to attend small specimens while they are hardening within the molds, or setting up. All doors are regular cold storage or refrigerator, doors.

A 5-hp. Kelvinator, with a cooling capacity equivalent to 800 lb. of ice per day is used for keeping the temperature of the room down to 70 deg. F. Four 250-watt Chromolox strip heaters are used to keep the temperature of the room up to 70 deg. F. Both the refrigerator and the heater are controlled by two thermostatic mercoid switches. The cooling coils, heaters, and the thermometer control bulbs are located within the room. The refrigerator compressor rests outside of the room, as do the mercoid switches, which are on a panel with two relay switches and a temperature recorder. The mercoids do not carry the full operating load but they control relay switches which do this work.

The air within the room is circulated by taking advantage of convection currents. The cooling coils are located near the ceiling above baffle plates which spill the cold air down at the center of the room, while the warm air rises adjacent to the walls.

The four long strip heaters are placed near the floor, one towards each corner. Small sprays keep the room at almost 100% humidity. A Brown wet and dry bulb temperature recorder keeps a continuous chart record of the moist room temperature, also its wet-bulb temperature, from which the relative humidity can be calculated.

With the above equipment the tempera-



The sifter in its enclosing cabinet and the small grinder

A corner of the chemical laboratory

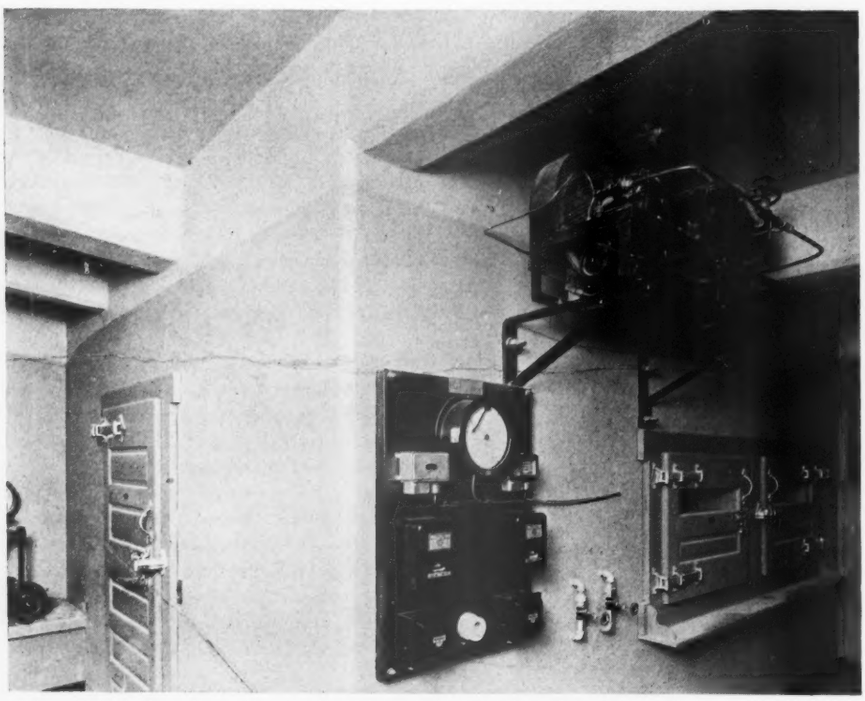
ture can be controlled within 1 deg. F., and the average temperature for 24 hours for practically all chart records is within two-tenths of a degree of 70 deg.

Concrete water tanks for storing 1:3 sand specimens, and shelves of iron gratings for storing concrete specimens and holding test pieces while setting and hardening, are located in this moist room.

The chemical laboratory furniture was built by Kewaunee to fit requirements.

A thick glass plate is set in the top of the bench where the acid-alkali titrations are run; below this an electric light shines; this shows up color changes to the best advantage, and is especially serviceable at night.

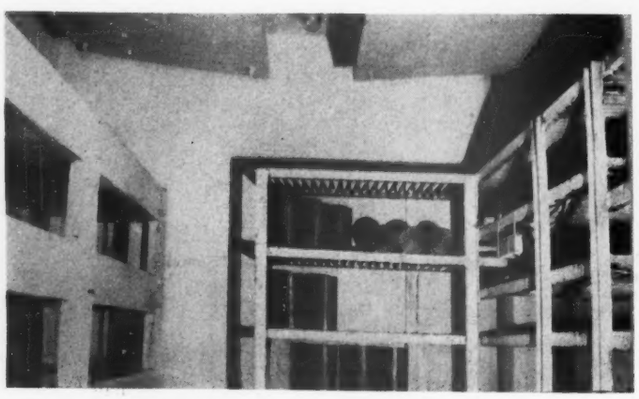
Most chemists have decided views as to which material is the best for laboratory bench tops. Owing to the diversity of resistance required no one material is perfect. In this case the usual Kewaunee construction of white birch strips is used. The worst disadvantage of this kind of top is the destructive effect of spilled acids. To reduce this effect to a minimum, two small Alberene stone troughs are run to an Alberene stone sink. Above these troughs rest dispensing burettes containing different acids in common use for cement analyses.



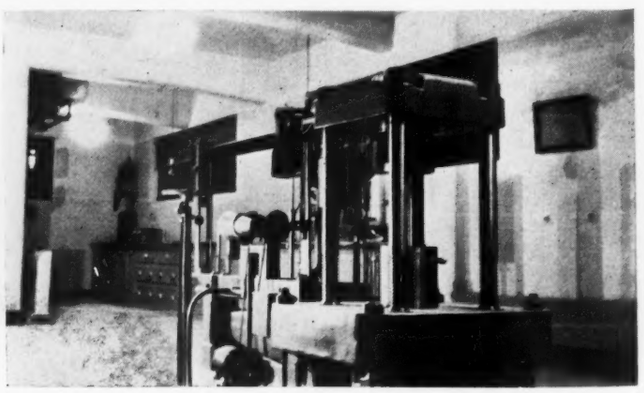
Control panel for the moist room showing the indicating and recording instruments

Wire Saws in the Slate Industry

THE UNITED STATES Department of Commerce, Bureau of Mines, has issued, under the direction of Oliver Bowles, mineral technologist, technical paper No. 469 on "The Wire Saw in Slate Quarrying." The pamphlet covers the uses and advantages of quarrying slate by this method which, incidentally, was developed and introduced by the engineers of the Bureau of Mines and can be had by addressing the Superintendent of Documents at Washington, D. C.; price 15 cents. The paper of 31 pages is well illustrated and brings out the subject clearly.



Interior of the moist curing room



Compression machine for testing concrete strengths

Prospecting for Potash Salts—Part II

Possible Locations for Test Drilling Designated

By H. N. Kirk
Keene, N. H.

MY FIRST ARTICLE (ROCK PRODUCTS, May 24, 1930) was a statement of theory; this article, in regard to the location of a possible place for drilling for a commercial deposit of potash salts, is a theoretical study on lines set forth in my first article. In this article I submit my idea of the theory put into practical use as to a possible and plausible location for drilling for potash salts.

Possible Potash Areas

The location I have selected as one of the possible sections in the southeastern states for finding potash salts is a section in the following states, including the southwest corner of Virginia and a portion of the northeast corner of Tennessee. The counties in Virginia are as follows: Wythe, Tazewell, Smyth, Washington, Russell and Scott counties. In Tennessee it includes the counties of Sullivan (northwest section), of Washington, Greene county, Hamblen, Cocke and Jefferson counties. My reasons for selecting these counties are that you have a deposit of salt at Saltville, Va., which may be a salt dome or may denote the possibility of salt domes in southwestern Virginia.

Salt domes are found associated with Germany's potash salt deposits; also salt domes have been located recently in Alsace in France.

Secondly, this region is land-locked, so to speak, by mountain ranges so that if the mountain ranges were formed when the potash salts were in a leached state they could have been held back to crystallize and form beds. The leached potash solution could have flowed into this natural basin and as the waters were dried up by the change of climate, ages ago, it left behind those solids that it carried into solution, potash salts and common salt. This land-locked section of land mentioned above compares very favorably to the position of Alsace potash deposits in France.

Thirdly, we have located just east of the section mentioned bauxite deposits of Carter county in Tennessee.

Fourth, we have south of Cocke county, Tennessee, the clay beds of Jackson and Macon counties in North Carolina.

Fifth, Tennessee produces phosphate rock which goes to show that organic life was present here in abundance in ancient times. Very likely the agencies that caused the formation of the phosphate rock also created a great change in the feldspathic rocks that caused their decomposition or alteration. The theory as to how the crust of the earth took its present formation and covered up the changes in organic matter and rocks is a question open to discussion.

Sixth, accepting the Bar theory as the cause of the immense beds of salt underlying Texas and central United States, some 100,000 square miles in extent or less, we have to conclude that the strata of salt in this section must be of ocean formation. If this is the case, this section is less likely to have potash salts deposits of good thickness near the surface (1500 to 2000 ft.). The formation of the mountains in the section I have mentioned have helped to concentrate and bring nearer the surface the potash salts.

Theory of Formation

The age in which phosphate rock was formed was at a time previous to the upheaval of the minor anticlines, synclines and other forms of the earth's folds. This can be proven, at least for that section in Idaho, by the deposit of phosphate rock about seven miles from Soda Springs, owned and operated by the Anaconda Copper Co. Here the bed of phosphate rock was at one time practically flat until agencies caused its upheaval here in an anticline with the top eroded, leaving two legs of phosphate rock exposed. Now accepting the fact that the agencies that caused the folding of the earth's crust also caused the forming possibly of salt domes and caused the decomposition or alteration of feldspathic and basal feldspathic rock, we must conclude that the potash salts were leached at this time and clay and bauxite were some of the by-products.

One must see that the age in which salt domes, phosphate rock, clays and bauxite were formed was the same or practically the same.

Potash in Arkansas?

Another location which seems favorable for the finding of potash salts is Arkansas in the counties of Calhoun, Dallas, Saline and Grant. On the north you have the bauxite deposits of Pulaski county and on the south the clay beds near Lester in Ouachita county. The mountains in the west and northwest section of Arkansas must have had a tendency to cause the drainage system to be directed in a southeasterly direction even ages ago when potash salts were in solution. This drainage system must have helped to concentrate any salts in solution at the time evaporation or crystallization took place.

The locating of salt domes in this section would tend to strengthen hope of finding potash salts, and the discovery of salt domes by any of the modern methods that are applicable such as seismic or gravitational methods should be used to locate them if possible.

Salt Domes Must Be Considered

Salt domes must surely be taken into consideration, as we find them in both Germany and France near the potash salts deposits. We must not expect to find potash salts underlying all the counties in the different states I have mentioned, but a local survey of the sections I have mentioned should lead to a definite district that would seem favorable for drilling.

Another point to be remembered is that the chances of finding potash salts are more favorable at near-surface locations at the head of drainage systems. We have this proven by the section in western Texas, where they are finding some potash salts which are near the head of drainage systems. In Texas near the coast region salt domes have been located and some potash salts have been found at great depth (4800 ft.). This tends to show that a workable potash salt deposit must be located at the head or one-third of the way down a drainage system.

Greater Exploration Necessary

The two articles written on potash salt prospecting were not written with the idea of criticising the Bureau of Mines, because all know that with the limited amount of money appropriated for its use by Congress it has shown very good results. It has never had a sufficient appropriation to carry out a more elaborate search for potash salts. Now that the Bureau's engineers have found what they consider a good emergency supply in western Texas and New Mexico, a further search should be made to find such large deposits that they would be available for immediate use in the manufacture of fertilizers and other uses to which potash salts are put.

The locations I have selected are good theoretical guesses. The valley west of the Blue Ridge Mountains in Virginia in my opinion should be surveyed for salt domes and several places in Georgia might be considered also.

These two articles on the location of potash salts will at least start a more widespread interest and I hope will create a

different feeling among our congressmen and senators so that they will be more generous in their appropriations to the Bureau of Mines and the Bureau of Soils.

New Russian Deposits

While the above article was awaiting publication comes the report that near the Upper Kama river in the northwest Ural district the Soviet Union of Russia there is developing what is expected to be the largest known potash deposit in the world. The Soviet Union expects to follow out a program that will increase the crop yield per acre of Russian farmers 30 to 35%, and this is by the aid of their own potash supply that is to give their farmers a high grade fertilizer at a low price.

Please notice that this increased yield at a less cost is what I call a permanent farm relief and does not play with the law of supply and demand which should make the price of a commodity.

If the Soviet Union can see where it is going to have farmers grow one-third more marketable produce on the same acreage, the United States government should expect our farmers to do as well if not better if supplied with a high grade fertilizer such as will be sold to the farmers in the Soviet Union.

Also notice that it was near the head of a drainage system that this rich deposit was found in a very concentrated, thick, rich deposit of large area. Also notice that the Ural Mountains must also have had a hand in concentrating and making this deposit one of commercial importance.

There are millions, yes, many millions of tons of potash salts here in the United States awaiting the lucky driller to locate.

No private individual or company can afford to carry out such a program of research work and drilling as is called for in the finding of these potash salts. Why should the United States government be so stingy, yes, stingy is the word that one should use when you read of the amounts appropriated to the Bureau of Mines or the Department of Agriculture for search for this most important salt—potash.

If a farmer were able to get the same yield on four acres that he did on five or six, is not this a permanent farm relief of the first order? But to do the above the United States farmer must have a high grade fertilizer at a low cost and to get this low priced fertilizer we must have domestic supplies of potash salts available for our own fertilizer makers at a low cost. This cannot be done unless we find rich commercial beds of potash salts.

Cement Plant for Brazil

THE first Brazilian cement plant, erected in Perus, Sao Paul, for 1000 bbl. capacity per day, is to be increased to 1500 and later to 3000 bbl.

Central California Gypsum Deposit to Be Developed for Land Plaster

INSTALLATION of new machinery throughout and the erection of a new building for employes at the old Paoli gypsum mine, in western Fresno county, California, 20 miles southwest of Whites bridge, is announced by the owner, A. P. Shepard, of 3107 Mariposa street, Fresno.

The new machinery includes a crusher, conveyor and an automatic machine for filling sacks with 100 lb. of the finished product. With the new equipment, the mine is now able to crush and sack approximately 20 tons of the gypsum or land plaster each day. A crew of five men is employed at the mine in handling the daily output from the mountain of gypsum which covers approximately 80 acres.

An analysis of the mine by Prof. E. W. Hilgard of the University of California showed "the material to be very nearly uniform from top to bottom; a yellowish white, chalky mass, easily crumbled and therefore readily put in shape for farmer's use. It is probable that the average of the whole deposit ranges about 90% gypsum."

Soil Functions of Gypsum

Beneficial functions of gypsum on California soils are outlined by the University of California, college of agriculture, in a circular sent through the Fresno county farm bureau office in the Holland building. As outlined by the circular they are:

"Gypsum exerts a physical effect similar to that of lime on the clay and adobe soils, improving the crum-structure and making it more pervious to water and air. Therefore gypsum makes clays and clay adobe soils looser, tends to prevent packing and baking, makes plowing and cultivating easier and, in general, makes the soil physically a healthful medium for plant growth.

"Gypsum, like lime, furnishes the element calcium, which is as essential for the growth of beneficial bacteria and other microorganisms of the soil as to the higher plants. Gypsum stimulates the beneficial soil organisms in the nodules on roots of leguminous plants, like the peas, beans, vetches, alfalfas and clovers.

"It will not change an acid into a slightly alkaline soil as do the lime materials. Gypsum possesses no alkalinity, and therefore will not be of assistance in case of or act as a corrective to 'sourness' or acidity in soils.

Toxic Effects Overcome

"Gypsum will neutralize the toxic effects of sodium carbonate or 'black alkali.' Where gypsum is used to neutralize or make harmless the black alkali, it 'cannot be replaced by lime,'" the report states.

"Gypsum may be used with advantage on alfalfa fields to stimuate growth. This is especially to be remembered in connection with alfalfa fields of several years' standing in which bare patches are found. An application of gypsum in such cases, not to exceed 300 or 400 lb. to the acre, alone with fall disking, will usually stimulate the plants and rejuvenate the field. The reason for this is believed to be that gypsum is a stimulant to the alfalfa plant itself and to the nitrogen-gathering bacteria that grow in the nodules on its roots."

For Use in Vineyards

In 1894, while Mr. Shepard was employed by the Southern Pacific Railroad Co. stationed at Mendota, he and James Hall inspected the land in Tumey gulch, section 13, township 15 south, range 12 east. The land is about five miles from the San Benito county line. Mr. Shepard and James and John Hall operated the mine until 1906 when it came into the hands of its present owner.

Although it is generally marketed in 100-lb. sacks, some of the gypsum is now being hauled in gondola cars to Patterson for use in vineyards and alfalfa lands.

Adjoining the gypsum deposit on the south is the diatomite deposit of the Mineral Products Manufacturing Co., Inc., of which Mr. Shepard has one-quarter interest. This deposit is not yet fully developed, having a daily capacity of 10 tons. The product is sold in 50-lb. lots.—*Fresno* (Calif.) *Republican.*

New Booklet on Concrete Masonry

PORTLAND CEMENT ASSOCIATION, Chicago, Ill., has just published a new booklet, entitled "Concrete Masonry—Haydite Building Units," of interest to manufacturers of concrete masonry using Haydite (burned clay or shale) aggregate. This is the fourth of a series of similar publications which has been issued by the association for manufacturers' use, the first three dealing with cinder-concrete building units, stone-tile building units, and concrete block (sand and gravel aggregate) building units, respectively.

No distribution of the booklet is being made by the Portland Cement Association. It has been issued, as have the others of the series, for use only by manufacturers, and copies are sold to them at cost. The association makes no charge for preparing the booklet, the only charge being for the actual printing, and only a sufficient number have been printed to take care of orders placed with the association prior to printing. If demands from manufacturers warrant it, a second edition may be printed.

The booklet is non-technical and is intended primarily as a sales aid. It features outstanding buildings of all types in which Haydite-concrete building units have been used. Space is left on the front and back covers for manufacturers to imprint their firm names and sales messages.

Recent Japanese Research in Portland Cements

Reviewed for Rock Products

By William A. Ernst

Chief Chemist, South Dakota State Cement Plant, Rapid City, S. D.

IN reviewing and abstracting recent Japanese literature on research in portland cements, in the case of the articles entitled "Studies on the Fundamental Synthesis of Calcium Aluminates and Their Hydration," I think it in the best interests of readers to include very briefly the preliminary articles already published in ROCK PRODUCTS, in order that the reader may have a connected review, since in my opinion this is a very important contribution for the cement manufacturer in general and the cement chemist in particular.

STUDIES ON FUNDAMENTAL SYNTHESIS OF CALCIUM ALUMINATES AND THEIR HYDRATION

By SHOICHIRO NAGAI and RYUICHI NAITO

In the authors' preliminary studies on two sorts of calcium aluminates ($CaO \cdot Al_2O_3$ and $5Ca \cdot 3Al_2O_3$), they found that they are readily formed by heating to a temperature far below their melting point of 1450 deg. C.

They prepared mixtures of Al_2O_3 and $CaCO_3$ in the proportions of 1:1 or 5:3, that is in proportions shown by the formulas $CaO \cdot Al_2O_3$ and $5CaO \cdot Al_2O_3$. By the determination of free lime in the heated mass, by the Lerch and Bogue method, and free alumina in the form of insoluble residue, the combined lime and alumina were obtained by subtracting the free lime and free alumina from the total lime and alumina determined in the original mixture.

The molar ratios of lime to alumina were obtained from these results of combined lime and alumina, and their values were compared to the molar ratio 1.00 of $CaO \cdot Al_2O_3$, or 1.67 of $5CaO \cdot 3Al_2O_3$.

FORMATION OF $5CaO \cdot 3Al_2O_3$ BY HEATING UNDER 1300 DEG. C.

Very much the same methods were employed in this case. Heating at 1200 deg. C. for 60 minutes the molar ratio, 1.16-1.18, indicates that some parts of $CaO \cdot Al_2O_3$ were mixed with $5CaO \cdot 3Al_2O_3$. Heating at 1250 deg. C. for 240 minutes the molar ratio increased to 1.35 and at last, heating for 900 minutes, the molar ratio was found to be 1.64, which is nearly equal to the theoretical value of 1.67 of $5CaO \cdot 3Al_2O_3$, leaving a very small quantity of free lime and free alumina.

FORMATION OF $5CaO \cdot 3Al_2O_3$ BY HEATING ABOVE 1300 DEG. C.

At about 1400 deg. C., $5CaO \cdot 3Al_2O_3$ sintered; at 1450 deg. C. (S.K. 15-16) it melted. Free lime and alumina disappeared and the molar ratio of the combined lime and alumina reached nearly to the theoretical value of $5CaO \cdot 3Al_2O_3$, or 1.667 (= 5:3).

FORMATION OF $CaO \cdot Al_2O_3$ ABOVE 1300 DEG. C.

$CaO \cdot Al_2O_3$ sintered at about 1500 deg. C. and melted at 1600 deg. C. (S.K. 26-27). The molar ratio increased to the maximum value 1.23 at 1350 deg. C. and then decreased to 1.01 or 1.02, being nearly equal to the theoretical value of $CaO \cdot Al_2O_3$ 1.00 (=1:1).

The tests on strength of 1:3 mortars of three high aluminous cements (two samples of the "Atlas Lumnite cement," and one of the "Ciment Fondu") were carried on, and the ratio of the compressive strength by the ordinary 7.07 cm. cube to that by the small-piece test (cylinder of dia. 2 cm. and length 3 cm.) was obtained at every age of hardening. This ratio will be used to calibrate the compressive strength of the 7.07 cm. cube 1:3 mortars of synthetic aluminates.

FORMATION OF $3CaO \cdot 5Al_2O_3$

The combination $3CaO \cdot 5Al_2O_3$, the aluminate of highest alumina content (Al_2O_3 75.2%, CaO 24.8%) was produced by the same method as in the case of $5CaO \cdot 3Al_2O_3$ and $CaO \cdot Al_2O_3$.

No.	Temperature in deg. C.	Time in minutes	Free CaO %	Free insol. residue %	Combined CaO%	Combined Al_2O_3 %	Molar ratio $CaO \cdot Al_2O_3$	Specific gravity
A 801	950	60	19.7	61.7	5.2	13.4	0.71	3.30
A 802	1050	60	16.2	57.1	8.8	17.9	1.12	3.32
A 803	1150	60	12.2	53.2	12.8	21.8	1.07	3.23
A 804	1250	60	2.5	36.8	22.4	38.2	1.07	3.16
A 805	1350	240	0	13.7	24.9	61.4	0.74	2.98
A 806	1400	60	0.9	34.5	24.1	40.5	1.08	3.14
A 807	1500	60	0	17.0	24.9	58.1	0.78	3.01
A 808	1500	60	0	17.4	24.9	57.7	0.79	3.00
A 809	1600	60	0	7.1	24.9	68.0	0.67	2.90

Free lime disappeared first and alumina still remained in A 809 heated at 1600 deg. C. The molar ratios of A 802, 804, 806 are 1.07-1.12, showing the formation of $CaO \cdot Al_2O_3$ first, and then the molar ratio decreased step by step, and $3CaO \cdot 5Al_2O_3$ slowly predominated, as in A 805, 808, 809, etc., by long heating at relatively low temperatures, or at higher temperatures 1500-1600 deg. C., etc., and at the melting temperature 1720 deg. C. (reported by A. Rankin, E. Wright, W. Dyckerhoff, P. H. Bates, etc.) $3CaO \cdot 5Al_2O_3$ will be completely combined.

SMALL-PIECE TESTS ON STRENGTH OF $5CaO \cdot 3Al_2O_3$ AND $CaO \cdot Al_2O_3$

The samples of these aluminates prepared by heating at 1250 deg. C., which is a lower temperature than the sintering, or melting point, of these aluminates, were tested for their properties of hydration first by the small-piece testing method proposed by one of the authors (this journal, 1929, 32, 635 and 641). The compressive strength of 1:3 mortars of these snythetic products are compared with those of high aluminous cements (Lumite cement, Ciment Fondu, etc.) The strengths of $5CaO \cdot 3Al_2O_3$ are clearly smaller than those of $CaO \cdot Al_2O_3$. The most important point is the decrease of strength in the long water curing, but there is the remarkable increase in the air curing or combined curing. The results are shown in Table No. 2.

The compressive strengths of the ordinary cubical test piece (7.07 cm.[8]) are obtained by $c \times C/c$ in which c is the actual results of the small-piece testing, and C/c will be obtained in the hyperbolic curve (this Journal, 1929,

FORMATION OF $CaO \cdot Al_2O_3$ BY HEATING UNDER 1300 DEG. C.

Temperature in Deg. C.		Free CaO	Free Al_2O_3 insoluble residue	Comb. CaO	Comb. Al_2O_3	Molar ratio $CaO \cdot Al_2O_3$
950		33.0%	54.1%	2.6%	10.2%	0.47%
1050		32.0	52.7	3.3	11.6	0.52
1100		26.3	50.2	9.1	14.2	1.17
1200	60 minutes	17.8	37.4	18.0	26.9	1.21
1250	420 minutes	2.4	7.8	32.7	57.1	1.04

It will be seen by the above table that heating at 1200 deg. C. for 60 minutes the molar ratio increased to its maximum 1.21, or 0.21 above the molar ratio 1.00 of $CaO \cdot Al_2O_3$, showing clearly that some $5CaO \cdot 3Al_2O_3$ was formed. The free lime and free alumina gradually disappeared until at 1250 deg. C. for 420 minutes the molar ratio very nearly equaled the theoretical value of $CaO \cdot Al_2O_3$ or 1.00 (= 1.01 — 1.02).

TABLE 2—TESTS OF COMPRESSIVE STRENGTH OF 1:3 MORTARS OF $5CaO{\cdot}3Al_2O_3$ OR $CaO{\cdot}Al_2O_3$ PREPARED AT 1250 DEG. C.

		1-day	2-day	3-day	5-day	7-day	7-day in air	28-day	28-day in air	28-day Comb.
		Kg./cm.²								
(1) A 511 $CaO{\cdot}Al_2O_3$	*C*	543	504	508	526	502	.....	439	.....	655
	c	81.1	61.4	62.7	65.8	61.3	.....	24.0	.....	122.7
	C/c	6.7	8.2	8.1	8.0	8.2	.....	18.3	.....	5.3
(2) A 512 $5CaO{\cdot}3Al_2O_3$	*C*	507	502	512	.....	545	704	542	643	715
	c	51.1	60.5	62.0	.....	89.4	156.5	83.4	119.1	238.5
	C/c	8.3	8.3	8.3	.....	6.1	4.5	6.5	5.4	3.0
(2) A 512 $5CaO{\cdot}3Al_2O_3$ + 3% gypsum	*C*	408	422	461	.....	533	571	546	554	687
	c	30.9	35.8	44.8	.....	74.0	75.1	94.2	66.7	149.3
	C/c	13.2	11.8	10.3	.....	7.3	7.6	5.8	8.5	4.6
(3) A 119 $CaO{\cdot}Al_2O_3$	*C*	610	605	599	.....	570	.....	561	.....	725
	c	179.6	172.9	161.9	.....	118.9	.....	107.8	.....	207.1
	C/c	3.4	3.5	3.7	.....	4.8	.....	5.2	.....	3.5
(4) A 120 $CaO{\cdot}Al_2O_3$	*C*	556	533	553	.....	549	718	523	720	718
	c	97.5	104.8	100.6	.....	94.7	211.4	66.2	194.7	217.6
	C/c	5.7	5.3	5.5	.....	5.8	3.4	7.9	3.7	3.3
(4) A 120 $CaO{\cdot}Al_2O_3$ + 3% gypsum	*C*	548	547	555	.....	561	714	537	688	729
	c	92.8	91.2	97.3	.....	103.9	204.2	85.2	152.9	235.4
	C/c	5.9	9.0	5.7	.....	5.4	3.5	6.3	4.5	3.1

32, 644 or 192 B, *Tonind.-Ztg.*, 1929, 53, 1408).

In A 512, only 3% addition of gypsum decreased remarkably the strength, especially at the short curing ages, 1, 2 or 3 days, which shows the formation of "Cement bacillus" $3CaO{\cdot}Al_2O_3{\cdot}3CaSO_4{\cdot}nH_2O$.

FORMATION OF $3Ca{\cdot}Al_2O_3$ AND OF TRANSITION BETWEEN $3CaO{\cdot}Al_2O_3$ AND $5CaO{\cdot}3Al_2O_3$

The experiment of (*a*) heating the mixture $3CaO{\cdot}Al_2O_3$ in the proportion of 3:1, (*b*) the analysis of free lime, insoluble residue (free alumina), combined lime and alumina, (*c*) calculation of molar ratio of combined lime to combined alumina, (d) determination of specific gravity of heated products, etc., were carried out as in previous determinations.

The results are tabulated in Table (3).

This result was compared with those of the other calcium aluminates $5CaCO_3{\cdot}Al_2O_3$, $3CaO{\cdot}Al_2O_3$ and $3CaO{\cdot}5Al_2O_3$, and the change of molar ratio of combined lime to combined alumina of these four aluminates was carefully noted. It was clearly demonstrated that $CaO{\cdot}Al_2O_3$ with a small proportion of $5CaO{\cdot}3Al_2O_3$ is first formed in every case of different proportions of lime and alumina, when the mixture was heated at 1100-1250 deg. C.

On further heating to higher temperatures, the molar ratio increased gradually to 1.67 (the theoretical value of $5CaO{\cdot}3Al_2O_3$) or to 3.00 (the theoretical value of $3CaO{\cdot}Al_2O_3$).

TABLE 3—FORMATION OF $3CaO{\cdot}Al_2O_3$

No. of Expt.	Temperature in deg. C	Time in minutes	Free CaO	Free Alumina (Insol. Res.)	Comb. CaO	Comb. Al_2O_3	Molar Ratio of $CaO{\cdot}Al_2O_3$	Specific Gravity
A 301	950	120	59.4%	30.7%	2.0%	7.0%	0.76	3.29
A 302	1100	60	52.6	22.7	9.7	15.0	1.17	3.25
A 303	1250	60	47.3	17.5	15.0	20.2	1.36	3.20
A 304	1350	60	32.0	4.4	30.3	33.3	1.66	3.02
A 305	1350	60	30.8	4.5	31.6	33.2	1.73	3.02
A 306	1400	180	4.5	0.2	37.8	37.5	2.81	2.98
A 307	1450	180	19.9	1.7	43.4	36.0	2.14	2.96
A 308	1500	180	4.9	0.4	58.0	37.3	2.80	2.95
A 309	1500	180	0.04	0.1	62.3	37.6	3.02	2.97
A 310	1550	60	0.2	0.03	62.1	37.7	3.01	2.97

TRANSITION BETWEEN $3CaO{\cdot}Al_2O_3$ AND $5CaO{\cdot}3Al_2O_3$

The repetition of heating the mixture $CaCO_3$ and Al_2O_3 in 3:1 or 5:1 promotes the transition from $5CaO{\cdot}3Al_2O_3$ to $3CaO{\cdot}Al_2O_3$ with increasing velocity depending on the heating temperatures. The results of repeated heating of the above mixtures and the transitions above mentioned were clearly demonstrated.

EXTRACTION OF FREE LIME IN THE HEATED PRODUCTS $5CaCO_3{\cdot}Al_2O_3$

The free lime in the mixture $5CaCO_3$ and Al_2O_3 heated at 1550 deg. C. was extracted by the glycerine-alcohol solution of ammonium acetate. The pure $3CaO{\cdot}Al_2O_3$ thus obtained was strictly equal in every point to A 309, or A 310 in the above Table 3.

(Institute of Applied Chemistry, Faculty of Engineering, Tokyo Imperial University.)

SMALL-PIECE TESTING ON STRENGTH OF CEMENT MORTAR

By SHOICHIRO NAGAI

In the ordinary testing method of strength of cement mortars, test pieces are molded by hammering with Böhme's hammer or Klebe's rammer apparatus with work-done of 54 kilogram-meters. By this work-done at the molding, results of strength test at short curing ages are unreasonably too high and not parallel with results of concrete tests. In other words, the ordinary testing of cement mortars is deviated far from the practical use of cement in concrete, or cement mortar, so that the results of this testing on strength of cement mortars do not express the proper hardening properties of cements.

Moreover, large amounts of cement are necessary in the ordinary testing method. Therefore, it can never be applicable to synthetic cementing materials, as calcium silicates, calcium aluminates, etc., etc.

Considering these points, the author proposed a new method of small-piece testing on the strength of cement mortars. Small cylindrical test pieces (dia. 15, or 20 mm., length 30 mm.) of cement mortars are molded and tested for compression strength.

The amount of water, or the water cement ratio (W/C) is the most important factor and is determined by the slump-test, or flow test, as in concrete. The small-piece testing method requires only about 4.5 grams of cement and 13.5 grams of ordinary standard sand to one test piece, or about 1/50 of the ordinary test piece of compressive strength (7.07 cm. cube). Using many samples of portland cements, alumina cements, mixed portland cements (blast-furnace-slag cements, iron portland cements "Soliditit," "Neo-Soliditit," etc.), compressive strengths of these small test pieces (*c* kg./cm.²) and of ordinary test piece (*C* kg./cm.²) are compared by calculating the ratio of (*C/c*) of these strengths and the relations between (*a*) *C* and *C/c*, and (*b*) *C* and Log *c*. The relation between *C* and Log *c* is a straight line. $C = a + b \times \text{Log } c$. (*a* and *b* are constants.) These results will be used in the fundamental studies of the most important hydraulic components of portland cement, alumina cement, etc.

The relation between *C*: compressive strength of 1:3-cement-sand mortars tested by ordinary test piece (7.07 cm. cube) and *c*: compressive strength of the same mortars tested by the small-piece (cylinder of dia. 2 cm., and length 3 cm.) is explained by the formula $(C.—C.')/(\log c.—\log c.') = B$. In the formula, *B* is a constant or an inclination of the straight line obtained in the Fig. 4 (*Journal of the Society of Chemical Industry, Japan*, 1929-32-645 and 193B). This constant *B* is considerably large in the case of mixed portland cements, as blast-furnace-slag cements, "Soliditit," "Neo-Soliditit," etc.

Water-cement ratios were studied by testing the relation between the slumps and the compressive strengths (*c*) of the small cylindrical test pieces, using every sort of cements. The increase of water-cement ratio from 60-65%, or from 65-70%, caused a decrease of strength of nearly 15-20%, 10-15%, or 5-10% of strength at 3 days, 7 days, or 28 days curing, respectively. Constants of strength formula $S = A + B \times \log d$, or $B = \frac{S—A}{\log d}$.

(Journal of the Society of Chemical Industry, Japan, 1929-31, 1268 and 301 B) of

cement mortars were calculated by using C= compressive strength of the ordinary 7.07 cm. cube; T=tensile strength of the ordinary test piece of 5 sq. cm. section, and c= compressive strength of the small cylinder test piece. The difference between portland combined curing (1 day in moist air, 6 days in water, and 21 days in air curing) to those on the ordinary 28-day water curing (1 day in moist air and 27 days in cements, blast-furnace-slag cements, "Soliditit" and "Neo-Soliditit," and alumina cements was clearly observed by comparing these constants.

The blast-furnace-slag cements obtained the greatest values, "Neo-Soliditit" cements, "Soliditit" and portland cements obtained smaller values.

The relation between chemical composition of cements and strengths of 1:3 cement-sand mortars on combined hardening was studied by using the small-piece testing method.

The results show that the alumina cements stopped the increase of their strength on long water curing. It owes to the dissolution of $3CaO \cdot Al_2O_3 \cdot nH_2O$, the hydrated product of the main hydraulic compounds $5CaO \cdot 3Al_2O_3$ and $CaO \cdot Al_2O_3$ of the alumina cements.—(*Silicate Institute, Department of Applied Chemistry, Faculty of Engineering, Tokyo Imperial University.*)

JAPANESE RESEARCH ON CEMENT STUDIES ON MIXED PORTLAND CEMENTS

By PROF. SHOICHIRO NAGAI
Department of Applied Chemistry,
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In a recent article the author outlined some of his studies on mixed portland cements. There are two sets of mixed portland cements, one being blast-furnace-slag cement, and the other "Soliditit" cement. The author studied first the manufacturing process of "Soliditit" (Japanese Patent 42160) and modified the process by adding one or more admixtures of a siliceous nature. This new mixed portland cement is named "Neo-Soliditit" and has just been patented (Japanese Patent 80692). The "Neo-Soliditit" is a high early strength cement which is comparable to superior foreign high early strength portland cements.

In the present paper the author reports the results of further studies on the new mixed portland cement. "Neo-Soliditit" cements No. 80-87, obtained by grinding mixtures of portland cement clinker (70-75 parts), calcined granite (10-20 parts) = the first admixture, and soluble siliceous matter, as kieselguhr, silica, earthy puzzolana, etc. (10-20 parts) = the second admixture, and have the chemical composition as shown in the following:

AVERAGE OF "NEO-SOLIDITIT" CEMENTS NO. 80-87

Loss on Ignition	Insoluble residue	Silica	Alumina	Ferric oxide	Lime	Magnesia	Sulphuric anhydride
2.60%	17.31	31.67	7.42	3.65	50.22	1.71	1.42

"Neo-Soliditit" cements contain a large amount of insoluble residue, and their true and apparent densities are smaller (about 7-9%) than those of ordinary portland cement.

Studies were made on the effects of admixtures of calcined products of various igneous rocks, also siliceous admixtures of artificial products, or by-products of other chemical industries, being used. The first class of admixtures, such as blast-furnace slag, clay, oralunite, etc., were mixed with the second class of admixtures, such as kieselguhr, silica earth, etc. This mixture (25-30 parts) was ground with portland cement clinker (70-75 parts) to the mixed portland cements. Some samples of this type of "Neo-Soliditit" cements were tested.

AVERAGE STRENGTH OF 1:3 MORTAR

Tensile Strength (kg./cm.²)						Compressive Strength (kg./cm.²)					
			Comb.	Comb.	Comb.				Comb.	Comb.	Comb.
Days	Days	Days	Days	Days	Days	Days	Days	Days	Days	Days	Days
3	7	28	28	56	91	3	7	28	28	56	91
35.5	37.7	42.6	54.9	45.5	46.5	435	557	640	721	687	713

Strength formulas of cement mortars (see ROCK PRODUCTS, January 18, 1930, p. 57) using the results of strength tests of "Neo-Soliditit" No. 80-87, and compared with those of two blast-furnace-slag cements, were found to be nearly equal to the blast-furnace-slag cements and apparently greater than that of a portland cement obtained from the same clinker. By comparison it is clear that the new mixed portland cement "Neo-Soliditit" is a better high early strength cement than the blast-furnace-slag cement, the compressive strength of 1-day curing of the former being considerably greater than that of the latter.

Additional studies on the "Neo-Soliditit" were made. The first admixture (16-20%) calcined rock, as granite, basalt, andesite, quartz porphyry, quartz trachite, serpentine, etc., was compared in its effects on the properties of the "Neo-Soliditit."

Tests on strengths of 1:3 mortars are shown in the average of five cements in Table No. 4.

Two samples of spent shale or spent ash of oil shale from Fushun in Manchuria were ground with and without one other admixture to clinker to mixed portland cement. See Table No. 5.

Mixed portland cements of the "Soliditit" type, as well as mixed portland cement of "Neo-Soliditit" type cements, were prepared by mixing clinker with the other ingredients, and compared with a normal portland cement (No. 175). (Table No. 6.)

The specific gravities of these special cements were all lower than that of normal portland cement. The initial and final setting time was somewhat longer. The insoluble residue in all cases was very much higher, ranging from 0.64 in portland cement to 27.93 in the special cements. The alumina and iron in every case was somewhat higher, and the CaO considerably lower, ranging from 62.89% in portland cement to as low as 34.68% in the special cements. There were comparatively slight variations in the MgO and SO_3.

With respect to the tensile and compressive strengths: These special mixed cements gave considerably higher strengths at long curing ages than normal portland cement, varying in tensile strength from 39 kg./cm.² in portland at 13 weeks to 52.2 kg./cm.² in special cements at 13 weeks. Compressive strength: 654 kg./cm.² in portland cement at 13 weeks; 709-816 kg./cm.² in special cements at 13 weeks.

TABLE No. 4. AVERAGE STRENGTH OF 1:3 MORTARS

Tensile Strength (kg./cm.²)						Compressive Strength (kg./cm.²)					
			Comb.						Comb.		
Days	Days	Days	Days	8 Weeks	13 Weeks	Days	Days	Days	Days	8 Weeks	13 Weeks
3	7	28	28			3	7	28	28		
27.7	31.8	39.2	46.9	42.8	44.7	443	544	676	751	710	732

TABLE No. 5. TOTAL ANALYSIS OF SPENT SHALE

No. of Sample	Loss on ignition	Insoluble residue	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Alkali by diff.
(a)	1.68%	77.40%	63.92%	20.89%	9.22%	1.19%	0.99%	1.68%	1.66%
(b)	2.01	82.10	62.08	19.14	12.78	1.13	1.38	0.35	1.13

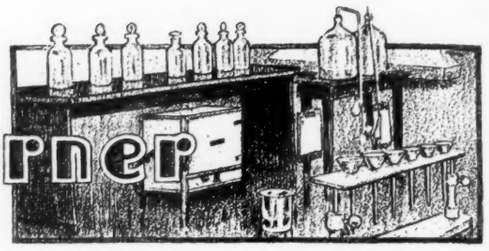
SOLUBLE PART OF SPENT SHALE

	Insoluble part						
(a)	39.57%	39.97%	11.57	5.08	0.29	0.21	
(b)	50.09	34.48	10.42	3.95	1.38	0.39	

TABLE No. 6. PROPORTIONS OF INGREDIENTS OF MIXED PORTLAND CEMENTS

Sample	Variety of cement	Clinker	Spent shale	Calcined granite	Siliceous earth	Gypsum
No. 175	Portland cement	100	....	....	....	4
No. 178	Mixed portland cements of "Soliditit" type	85	15	....	....	4
No. 169		75	25	....	....	4
No. 179		65	35	....	....	4
No. 180		55	45	....	....	4
No. 168	Mixed portland cement of "Neo-Soliditit" type	75	10	15	....	4
		75	15	....	10	4

The Chemists' Corner



Lime Satiation Ratio of Portland Cement

By S. Rordam

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IN JUDGING the chemical composition of a portland cement, in the past it has often been customary to use various more or less empirical ratios and formulas. Some of these formulas have not allowed for the fact that the three "acid" constituents of portland cement—the silica, the alumina and the iron oxide—have very different capacities for combining with lime.

The very interesting research work carried out by Dr. R. H. Bogue and associates, under the auspices of the Portland Cement Association fellowship at the Bureau of Standards, seems to have proved that the four major constituents of ordinary portland cement are:

$3CaO \cdot SiO_2$
$2CaO \cdot SiO_2$
$4CaO \cdot Fe_2O_3 \cdot Al_2O_3$
$3CaO \cdot Al_2O_3$

The role played by the magnesia is as yet somewhat uncertain, but it is assumed that no great error is committed by considering it as being present as uncombined MgO.

A cement which contains the theoretical maximum of lime would, in the main, consist of the following three components:

$3CaO \cdot SiO_2$
$4CaO \cdot Fe_2O_3 \cdot Al_2O_3$
$3CaO \cdot Al_2O_3$

In judging in how far a certain cement is high or low in lime, it is very instructive to caculate the amount of lime required to convert the SiO_2, Fe_2O_3 and Al_2O_3 into the above three compounds, and to compare this figure for the theoretical maximum lime content with the actual lime content of the cement.

The ratio: $\frac{\text{Actual Lime}}{\text{Maximum Lime}}$, which might be termed the *Lime Satiation Ratio,* is an indication of how near the lime content of the cement is to the theoretical maximum.

In actual practice this ratio will always be less than 1. But some of the modern quick-hardening cements are getting very near to the theoretical maximum for lime content.

The article by R. H. Bogue, in Rock Products, November 9, 1929, "Calculation of the Compounds in Portland Cement," deals in detail with the calculations for the conversion of silica, alumina and iron oxide to the respective lime compounds.

Briefly summarized, the following factors are used:

Each 1% SiO_2 combines with 2.8% CaO to form $3CaO \cdot SiO_2$.

Each 1% Fe_2O_3 combines with

$$\left\{\begin{matrix} 0.64\%\ Al_2O_3 \\ 1.4\%\ \ CaO \end{matrix}\right\}$$

to form $4CaO \cdot Fe_2O_3 \cdot Al_2O_3$.

Each 1% of the remaining Al_2O_3 combines with 1.65% CaO to form $3CaO \cdot Al_2O_3$.

Each 1% SO_3 combines with 0.7% CaO to form $CaSO_4$.

Using these factors, one would get the formula for the lime satiation ratio as shown below.

The nearer this ratio is to 1, the nearer is the cement to complete lime satiation. If the ratio is more than 1, it indicates an excess of lime, which no amount of burning could eliminate. Most of the normal portland cements have a lime satiation ratio between 0.88 and 0.91.

The formula does not take into consideration the question of uncombined lime. This feature belongs to the actual manufacturing control, but in examining a finished product one would of course have to allow for it.

$$\frac{\%CaO - SO_3 \times 0.7}{\%SiO_2 \times 2.8 + \%Fe_2O_3 \times 1.4 + (\%Al_2O_3 - \%Fe_2O_3 \times 0.64) \times 1.65}$$

or, in a more simplified form:

$$\frac{\%CaO - SO_3 \times 0.7}{\%SiO_2 \times 2.8 + \%Fe_2O_3 \times 0.34 + \%Al_2O_3 \times 1.65} = \text{L.S.R.}$$

As an example of the use of the formula, the lime satiation ratios have been calculated for two cements:

	High-early strength	Ordinary portland cement
SiO_2	20.7%	22.8%
Fe_2O_3	3.5	1.6
Al_2O_3	5.5	5.3
CaO	65.0	66.2
MgO	1.2	0.9
SO_3	1.4	1.6
Insoluble	0.2	0.2
Ignition loss	1.7	1.4
Lime satiation ratio =	0.94	0.89

Analysis of Article by Katsuzo Koyanagi on Iron vs. Alumina

By ALTON J. BLANK

General Superintendent and Supervising Chemist, Compania de Cemento Portland "Landa," S. A. Puebla, Puebla, Mexico

KATSUZO KOYANAGI, Tokyo, Japan, in an article appearing in "The Chemists' Corner" of the May 10, 1930, issue of Rock Products, gives some very interesting results of experiments carried out in his plant on the subject "Iron Oxide vs. Alumina as a Fluxing Agent in the Manufacture of Portland Cement."

Mr. Koyanagi takes his original high silica cement and to it adds a pyrite cinder of high iron oxide content, gradually increasing the pyrite cinder admixture until the iron oxide content of the cement has been increased 1.14%. Of the four tests reported in his Table No. 1, each composes one month's duration on a cement plant scale of experimentation. A summary of the results shows that as the iron oxide content of the cement is increased, a corresponding decrease is had in the tensile and compressive strengths of the cements, while increased unsoundness is obtained. However, as the iron oxide content of the cement increases there is a gradual increase in the kiln outputs with a corresponding decrease in fuel consumption.

Starting with the original cement we find an ignition loss of 0.83%, this ignition loss gradually increasing from test to test until at Test No. 5 we find the ignition loss to be 1.28%, or 0.45% higher. Ordinarily this increase in ignition loss would be assumed to be due to one of two causes, or to both,

being, (1) underburning of the cement, or (2) careless storage of the cement samples which resulted in their absorption of carbon dioxide and moisture from the atmosphere. Should the increased ignition loss be due to underburning of the cement, then the decrease in the strengths and increase in unsoundness can be readily explained. However, should the increased ignition loss be due to careless storage of the cement samples then the decrease in strengths shown can be easily accounted for in that small samples of cement carelessly stored over certain periods of time have their strengths effected detrimentally. To that end, an explanation of the increased loss on ignition from the first to the last cements should have been included in the article.

In the perusal of the lime ratios of each cement certain errors are to be found in the calculations which, though small, could have considerable bearing on the results obtained. For example, Cement No. 1 has a lime ratio of 2.16 instead of 2.14 as shown in Table No. 1, while Cement No. 5 has a lime ratio of 2.18 instead of 2.14 as reported. In certain cements a difference of a few hundredths of 1% in the lime ratios results in the cements being sound or unsound, and in the kiln outputs and fuel consumptions being low or high. In the remaining cements there is also to be found a difference in the lime ratios from that reported.

.Perusal of the chemical analysis of the pyrite cinder used as an admixture to the normal cement mixtures shows this cinder to contain 1.56% of sulphur. Whether this sulphur is present as a sulphide or a sulphate, is not reported. Should this sulphur be present as a sulphide and there be a reducing atmosphere instead of an oxidizing atmosphere present in the kiln, the resulting clinker would contain sulphides which are detrimental to the soundness and strength of the cement. Theoretically, all sulphur present in the raw materials is driven off in the kiln at a temperature lower than is required for clinkering. However, this theory applies only when oxidizing atmospheres are had in the kiln. Practically, in the majority of cement kilns, a reducing atmosphere is more often had than an oxidizing one, this being particularly true in plants striving for fuel economy where the atmosphere is usually held as near neutral in the kiln as is possible. Incidentally, materials containing no sulphur will absorb small quantities in their passage through the kiln where coal and oil are used as fuels.

The writer's experience with sulphur containing raw materials has been to the end that poor combination of the materials is had in the kiln together with low kiln outputs and high fuel consumption, resulting in a finished product having low strengths, a tendency towards unsoundness, and usually a discoloration of the cement.

To that end, an explanation of the sulphur content of the pyrite cinder might have been reported in the article.

In the writer's own tests with iron oxide admixtures to normal cement mixtures it was found that too much iron oxide could be added, thus causing certain of the benefits to be destroyed; thus a happy medium was maintained to obtain the best all around results.

Columbia Silica Co. Reports Rushing Business

THE COLUMBIA SILICA CO., which operates the large sand refining plant on Copley road, Akron, Ohio, has doubled its business in the last year, Pierce A. Snyder, president and former Second ward councilman, reported recently.

This increase in car loadings in April this year over the same month last year was 110%, Snyder said, and the loadings so far in May were running at the same rate over May last year.

A fire wiped out the old plant more than a year ago and Mr. Snyder built a modern fireproof plant inside of a month after the blaze. [This plant was described in ROCK PRODUCTS, March 15, 1930.]

Production capacity was increased in the new plant, and this allowed Mr. Snyder to increase his sales force and reach into territory never before touched by the Columbia company. Sand is now being shipped from Akron to practically all points in the east and as far west as Chicago.

Sand produced at the Copley road plant is being used chiefly for sandblasting and for small water filtration plants. Large amounts of gravel also are being produced.

After the fire early in 1929 Mr. Snyder was deluged with offers from other cities urging him to move his plant out of Akron. Many of the cities offered attractive concessions if he would locate his plant in their vicinity. He refused.—*Akron* (Ohio) *Beacon-Journal.*

Construction Industry Begins to Strike Healthy Stride

EVIDENCE that the volume of legitimate contract construction, despite a decrease in gross dollar value for all building, is now greater than at the same time in either 1928 or 1929 is revealed in a statistical study just completed by the Associated General Contractors of America, which also shows that a new all-time high record was established in the total award of surface pavement contracts during the first three months of the year. The total of these awards increased 63% over that of the first quarter of 1929, the study indicates.

Bearing out its earlier predictions that there is to be an exceptionally large volume of engineering construction this year, the association's analysis discloses that long term state and municipal bond issues for the first quarter ran well in advance of the same period last year, totaling $106,000,000 for March and averaging $96,700,000 monthly as compared with $88,200,000 during the first quarter of the previous year.

According to E. J. Harding, assistant general manager of the Associated General Contractors, the effect of this public works acceleration is strikingly marked in the phenomenal increase in the total yardage covered in the pavement contracts. During the first three months of 1930 contract awards were made for 27,200,000 sq. yd., as compared with 16,700,000 during the first quarter of 1929. With contemplated work in this field continuing to come forward, and with the increased highway program made possible by upward revision of federal aid appropriations, Mr. Harding states that engineering construction faces a banner year.

Although the first 14 weeks of the year show a decline in the total value of contracts awarded for the various classes of construction, this decrease is attributed wholly to the elimination of speculative building, which in turn is spurring legitimate construction to greater and sounder activity.

Mr. Harding points out that the net decrease in the grand total embraces a substantial decline in commercial building and a larger drop in residential building—the two fields in which speculative operations had been particularly rampant—whereas in the unspeculative field of all types of legitimate contract work a definite increase is indicated.

Florida Rock Company Adds Concrete Tile Plant

THE MAULE OJUS ROCK CO., Ojus, Fla., has completed a new cement products plant approximately 50 by 75 ft. at its plant in Ojus to be used in the manufacture of concrete drain tile. This tile is made in sizes from 6 to 30 in. in diameter and is adapted to various demands of drainage and sewage disposal. The new addition to this department will increase the capacity to 50 tons of pipe per day.

The machinery for the plant was manufactured in the blacksmith shop department of the concern, where for more than three years the company has been turning out an increasing volume of wrought iron work.

H. W. Link, secretary, said that business in both the wrought iron works and garden furniture divisions, as well as the tile plant of this concern, has shown a satisfactory increase during the last two years.—*Miami* (Fla.) *Herald.*

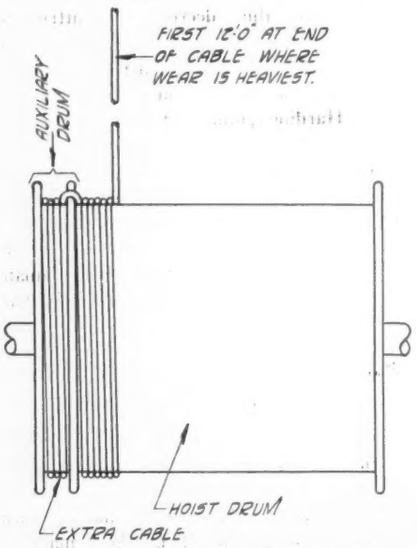
Mining Industry of Idaho

STEWART CAMPBELL, Inspector of Mines, State of Idaho, has issued the Thirty-first Annual Report of the Mining Industry of Idaho for the year 1929. Idaho's mineral resources are headed by the production of lead, followed by silver, zinc, gold, copper and antimony in the order given. The nonmetallic minerals include asbestos, barytes, bentonite, feldspar, phosphate rock and others of minor importance.

Hints and Helps for Superintendents

Economical Use of Wire Cable

HOW MANY TIMES has an operator had to throw away a length of wire cable due to a worn end? Splicing in a new section is not always advisable or possible, especially where the end has to pass through



Auxiliary drum carries extra wire cable for replenishing worn ends

a sheave or series of sheaves as on a clam-shell bucket. The Ross Island Sand and Gravel Co., Portland, Ore., has devised a novel method of overcoming this difficulty.

The greatest wear is on the closing line and is confined to about 12 ft. near the outer end, and if a single length of wire were used the loss of this 12 ft. virtually means the loss of the entire line. The operators here purchase double the amount of line needed and carry the excess on an auxiliary spool, which is part of the main drum, and as needed 12-ft. lengths are cut off from the worn end and replenished from the spool.

Removing an Old Concrete Storage Silo

IN connection with the hydraulic stripping operations at the Cape Girardeau, Mo., quarry of the Marquette Cement Manufacturing Co. it was necessary to remove an old storage silo on the property. This was done in a simple manner and economically by simply playing the jet from the hydraulic monitor on the earth substructure of the silo. The pictures show the course of removal. A stream of water under 190 lb. pressure through a 2¼-in. nozzle was used.

Stream of water playing on dirt under silo

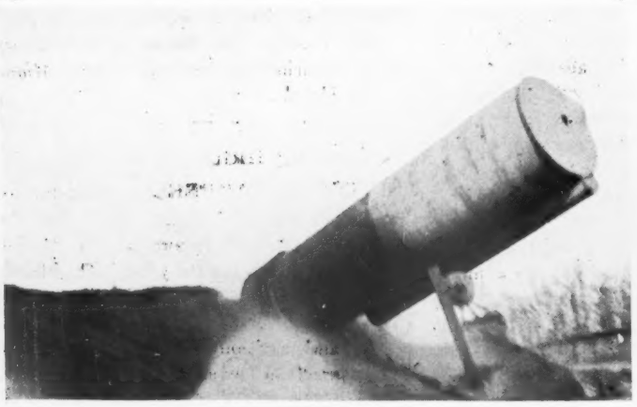
Bronze-Welding a Jaw Crusher

A COMPOUND fracture developed in the side-housing casting of a 36-in. by 50-in. jaw crusher in use at a midwestern cement mill. The fractures were caused by the breaking of a tooth in a pinion which meshed with a large gear. The broken tooth caught between the pinion and the gear and cracked the side-housing casting in several places.

When this crusher broke in several places the superintendent immediately called in the plant's oxy-acetylene service operator for advice. The service operator examined the crusher and found that there was approximately 27 ft. of welding to be done to repair the casting, and though the job could be done successfully by bronze-welding, it would require the services of several competent operators to do the job properly.

Since this plant employed only one welder, it was out of the question for them to handle the job themselves. Consequently the job was turned over to a nearby contract welding shop, which guaranteed to reclaim the casting in place by bronze-welding.

The job required but little over four days to complete and reinstall the repaired crusher. To get a new casting would have taken about three weeks, a serious loss of time, for there was only enough crushed



The above view was taken as silo was falling

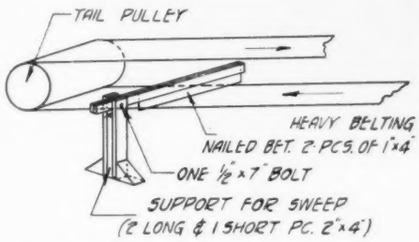
Showing silo after it fell and broke on rock

limestone on hand (before the crusher break) to supply the plant for 4½ days. Actual cost of placing the casting back in service was about two-thirds the price of a new one. The pinion gear which originally caused the trouble had one tooth broken and this was replaced by welding also.—*Oxy-Acetylene Tips.*

Protector for Belt Conveyor

By S. G. McANALLY
Egypt, Penn.

WHERE belts are used for conveying crushed rock, clinker, etc., sometimes pieces of rock fall on to the underside of the belt and are caught between it and the tail pulley, and damage the belt. A piece of belting placed across the underside of the conveyor belt, several feet away from the tail pulley and at an obtuse angle to the line



Simple type of sweep used for protecting belt conveyor

of travel, will sweep off the pieces of rock.

A simple type of sweep is shown in the accompanying sketch. A piece of heavy belting, wider than the conveyor belt, is nailed between two pieces of 1 x 4 in. The latter extend to the side support and are held in position by one bolt only. The side support is made from three pieces of 2 x 4 in. nailed together and fastened to the floor.

Cars with Grizzly Tops

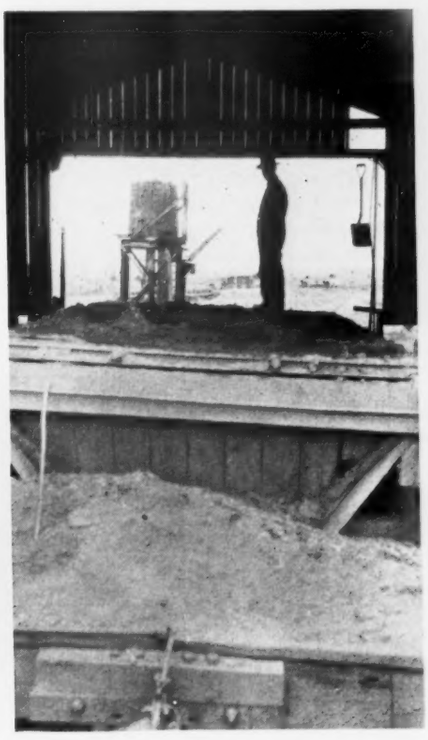
THE MASSAPONAX SAND AND GRAVEL CORP., with an operation near Fredericksburg, Va., and one at Bowie, Md., has developed an uncommon but not a novel method of taking care of the large

Showing the construction of bottom-dump cars with grizzly tops

View showing rails on top of the cars

boulders that sometimes are present in the deposit at Fredericksburg.

The cars are standard gage with bodies holding roughly 30 tons each, and are bottom dumped. Over the top of each car is a rail grizzly spaced so as to give about an 8-in. opening. The drag line dumps direct to the cars and any oversize can be sledged through or, if the oversize happens to be clay or foreign material, can be discarded at some convenient location between the plant and the pits.



Rails are spaced with 8-in. openings and completely cover top of the cars

We have seen many operations, especially when clay or conglomerates were present in the deposits, where this unwanted material was hauled to the plant and there passed over a grizzly, dumping the waste around the feed hopper. This latter procedure invariably means a lot of muck cluttered around the plant that sooner or later has to be hauled away, which is not only costly but unsightly at all times. These car-top grizzlies are sometimes made in an inverted V-shape, so that the oversize or rejected material is discarded at the loading point.

Elevator Oiler

A PAN CONVEYOR or elevator, if properly designed *and oiled,* requires only a nominal amount of power, but if the links in the chain making up the elevator are not lubricated the power required runs into real money. Not only does the power load climb, but the life of the moving parts is shortened,

Elevator oiler made from piece of pipe with welded ends

and greatly so where the elevator is handling an abrasive material.

No one appreciates the effect of abrasion more than slag producers, and for combating this problem the operators of the slag screening and crushing plant of the Sloss-Sheffield Steel and Iron Co., Birmingham, Ala., have made an oil reservoir of a piece of 6-in. pipe with welded ends and with two globe valves that are so located that a steady stream of light oil is allowed to drop on to the conveyor chains. A large opening is provided for filling. If equipment is idle the operator shuts off the oil stream.

Barges of Novel Construction

THE WARNER CO., of Philadelphia, annually transports several million tons of sand and gravel to Philadelphia and the various cities on the Delaware river, so its progress in designing and construction of barges should be of interest to the industry.

Recently, the engineers of the Warner Co., co-operating with those of the Dravo Contracting Co., designed a novel type of barge which has been placed in operation on the river and is being watched by the engineering departments of both companies, as it is considered to be more or less of an experiment to determine the type of barges that will be built in the future.

From this elevation can be seen the cabin doorways and end construction

The rolled top of the sideboards is shown in this illustration

Already it has been found that there was not sufficient drainage at the corners and additional scuppers have been placed at those points. The design is intended to minimize damage due to the daily bumpings with wharves, other barges and tugs; to minimize wear and tear on sideboards and decks due to the battering and scraping from crane buckets, and to improve the drainage facilities.

This barge, known as No. 53, is a wooden hull boat fitted with a steel deck and sideboards. This steel construction completely replaces all deck beams, timbers, decking, gunwale logs, sideboards and end bulkheads that were formerly of wood.

The rim construction of the sideboards is of particular interest, being of steel plate and bent into a semi-circle, 6 in. in diameter with a 6-in. channel for a stiffener. When a bucket hits the rail, it strikes a glancing blow and slides off. The brackets or stanchions supporting the sides are also made of bent plate which present a skidding surface to another barge or tug boat.

To allow for drainage, the steel sides do not come all the way down to the deck but are separated about one inch. On the outside of the side walls, an angle iron has been riveted to the deck, a short distance away and presenting a vertical riser about 2 in. in height. The water comes out under the lower edge and rises vertically to flow over the top of the angle iron. Under certain conditions, it has been found that sand will well up, and this feature will be remedied by plans the engineers have in mind.

The Warner Co. is having four new all-steel barges built, using the same design as used in No. 53 except that steel is replacing wood. It is expected that more and better service will be secured out of steel construction as against wood.

The life and utility of this type of barge should be watched with extreme interest by the sand and gravel producers of other districts, as unquestionably the experience and practice of the Warner Co. are of such wide scope and magnitude that water shippers can well learn something from a study of the Warner operations.

Barge No. 53 is neatly painted in green and buff, the official Warner colors.

A steel-decked barge of novel construction owned by Warner Co., Philadelphia

Noah Q. Speer, Pioneer Glass Sand Producer

NOAH Q. SPEER of Berkeley Springs, W. Va., died recently at the age of 93 years. He was born in Belle Vernon, where he attended the public schools and later was a student at Washington and Jefferson College.

After graduation from college, Mr. Speer started his business career in the production of glass sand. He had offices in Pittsburgh, where he conducted experiments to learn better ways to handle glass sand. Many of the appliances he invented are still used in the industry. In 1905, he retired and went to Berkeley Springs to live. His wife was Mrs. Alline Bugher Speer, who died in 1920.

Surviving him are two sons, L. M. Speer and N. Q. Speer, and four daughters, Mrs. William P. Leggett, Mrs. J. A. Proctor, Mrs. F. S. Reed and Mrs. William B. Lambing.

Charles E. Dalrymple Starts New Sand Company

CHARLES E. DALRYMPLE, who has been with the Raritan River Sand Co., New Brunswick, N. J., for more than 12 years, has resigned his position to become president of the Dalrymple Sand and Gravel Co. John B. Dalrymple, his son, will be associated with him, as will Edward Lorenson, both of whom are officers in the Raritan Trucking Co. The new sand company will begin operations at once.

Mr. Dalrymple, Sr., is well known in this city, where he has been in business for a long period of years. He is a member of the New Brunswick Rotary Club and much interested in the Boy Scouts. He has a wide circle of friends in the business world and he is highly esteemed by all.—*New Brunswick* (N. J.) *Times.*

Editorial Comment

Why Lime Manufacturers Should Co-operate

Those lime manufacturers of the United States who failed to attend the annual convention in Chicago on June 3 and 4 missed an opportunity to help themselves which is hard to justify. The lime industry has been through many vicissitudes and several national reorganizations, which are now ancient history. No industry has needed an effective organization more; and now it has one. That something less than 50% of the production of the industry is at present represented in this association is a reflection on the industry, not on the association.

It is hard for any kind of an organization, even if only a partnership, to function when 50% of it is apathetic. And 50% of the lime industry has been, up to the present, apathetic to all attempts of a few earnest, sincere and devoted leaders to find a way out of the problems which beset it. Of course, the lime industry in some respects is no different than all others, except that the others have probably done more to help themselves than the lime industry, because they had not allowed their industries to reach quite so difficult a position. It is always harder to recover lost business or prestige than to maintain it, but everyone knows that no business or prestige is irrevocably lost, and a temporary loss is merely a challenge to the resourcefulness of courageous men.

The National Lime Association now has a tried and specific program for the promotion and benefit of the lime industry—a program that will cost roughly in the neighborhood of $111,000 for the fiscal year 1930-31. It is hard to see how any man who looks to the lime industry for a living can fail to subscribe to it. To be sure it will cost a few cents per ton—3½c to be exact—but this is not an expense. Every business man knows that you have to spend money to make money. You have to pay for your lime before you offer it for sale.

There will always be a demand for lime, it is true. The demand for lime in the industries — so-called chemical industries—has grown constantly, with very little expenditure or effort on the part of the lime manufacturer. But that is merely evidence that the demand might have been—and still may be—a great deal more with the application of universally recognized modern promotional efforts. Chemical lime has now assumed the most important place in the lime industry — over 50% of the production—but largely because its inherent virtues make harder the finding of substitutes.

In the construction field lime has inherent virtues, too, virtues that even manufacturers of competitive materials can't deny, but it also has some inherent weaknesses as a modern material of construction that its competitors have taken full advantage of. That its virtues will remain, and that its weaknesses may be overcome, there is not the slightest doubt. The Lime Association with its present program is prepared to cope with the situation and open up both new and old fields.

A good share of the budget of the association is designed to be spent for advertising in trade and industrial journals. Such a step is fundamental. Indeed under present commercial and industrial conditions there is no other way in which a material or an industry can attain or recover *prestige*. With competitors of all kinds shouting the virtues of their materials from the housetops, mere possession of a material with virtues is not enough. Like it or not, you have to join the modern procession if you would stay in business.

The collection and dissemination of monthly statistics of production and shipments is fundamental. You can't crowd your competitor off the map—or if you do you merely change the ownership or management of his plant. You can't expect to operate continuously at 100% capacity, if your competitors can't operate at more than 50%. It is not human nature. You merely invite them to take away some of your business by hook or crook. You may have a more efficient, lower cost operation, but when the competitor gets desperate, he may ruin himself, and in doing so he may break you, too. Of course, this is merely a repetition of the recent experiences of many producers.

Such methods of doing business are archaic. The National Lime Association has taken the first progressive step to give producers in the industry the statistical facts to guide their individual businesses intelligently. Any lime manufacturer who is unwilling to aid and assist this work is plainly hamstringing himself.

It is true the lime industry is an individualistic industry. So are most other industries. So is our country. So is the whole theory of our American democracy; our laws, written and unwritten, are designed to uphold and preserve individualism. But individualism doesn't mean isolation and ignorance.

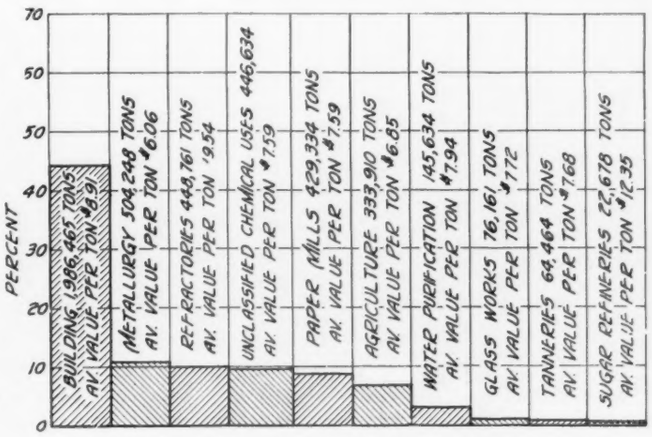

PERCENT
70
50
50
40
30
20
10
0
BUILDING 1,906,465 TONS AV. VALUE PER TON $8.91
METALLURGY 504,248 TONS AV. VALUE PER TON $6.06
REFRACTORIES 448,761 TONS AV. VALUE PER TON 19.54
UNCLASSIFIED CHEMICAL USES 446,634 AV. VALUE PER TON $7.59
PAPER MILLS 429,334 TONS AV. VALUE PER TON $7.59
AGRICULTURE 333,910 TONS AV. VALUE PER TON $6.85
WATER PURIFICATION 145,634 TONS AV. VALUE PER TON $7.94
GLASS WORKS 76,161 TONS AV. VALUE PER TON $7.72
TANNERIES 64,464 TONS AV. VALUE PER TON $7.68
SUGAR REFINERIES 22,678 TONS AV. VALUE PER TON $12.35

Chart showing breakdown of lime tonnages based on U. S. Bureau of Mines figures for 1928

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[29]	6- 3-30	95	100	
Alpha P. C. new com.	6- 2-30	30⅛	32½	75c qu. Apr. 15
Alpha P. C. pfd.	5-28-30	110	.....	1.75 qu. Mar. 15
American Aggregates com.[29]	6- 3-30	20	.....	75c qu. Mar. 1
Am. Aggre. 6's, bonds (w.w.)	6- 3-30	85	87	
American Brick Co., sand-lime brick	6- 2-30	.....	7	25c qu. Feb. 1
American Brick Co. pfd., sand-lime brick	6- 2-30	72	.....	50c qu. May 1
Am. L. & S. 1st 7's[29]	6- 3-30	95	97	
American Silica Corp. 6½'s[49]	6- 3-30	No market		
Arundel Corp. new com.	6- 3-30	44¼	44⅞	75c qu. Apr. 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	6- 3-30	60	70	
Beaver P. C. 1st 7's[20]	5-17-30	94	98	
Bessemer L. & C. Class A[4]	6- 2-30	31	33	75c qu. May 1
Bessemer L. & C. 1st 6½'s[4]	6- 2-30	87	90	
Bloomington Limestone 6's[29]	6- 3-30	83	85	
Boston S. & G. new com.[47]	6- 2-30	16½	19½	40c qu. Apr. 1
Boston S. G. new 7% pfd.[47]	6- 2-30	47	50	87½c qu. Apr. 1
California Art Tile A	5-29-30	.....	12	43¾c qu. Mar. 31
California Art Tile B	5-29-30	.....	4¾	20c qu. Mar. 31
Calaveras Cement com.	5-29-30	10	13	
Calaveras Cement 7% pfd.	5-29-30	86¼	89	1.75 qu. Apr. 15
Canada Cement com.	6- 2-30	16½	17¼	
Canada Cement pfd.	6- 2-30	95	98	1.62½ qu. June 30
Canada Cement 5½'s[43]	5-30-30	99½	100	
Canada Cr. St. Corp. bonds[43]	5-30-30	95	98	
Certain-teed Prod. com.	6- 2-30	9¼	10	
Certain-teed Prod. pfd.	6- 2-30	25	29	1.75 qu. Jan. 1
Cleveland Quarries	6- 2-30	66	70	75c qu. 25c ex June 1
Columbia S. & G. pfd.	5-19-30	94½	96	
Consol. Cement 1st 6½'s, A	6- 3-30	No market		
Consol. Cement 6½% notes[24]	6- 3-30	75	80	
Consol. Cement pfd.[29]	6- 3-30	50	60	
Consol. Oka S. & G. 6½'s[12] (Canada)	6- 2-30	100	101	
Consol. Rock Prod. com.[44]	5-29-30	1¾	2¼	
Consol. Rock Prod. pfd.[44]	5-29-30	10½	11½	43¾c qu. June 1
Consol. Rock Prod. units	5-26-30	22¾	25	
Consol. S. & G. pfd. (Can.)[43]	6- 2-30	82	85½	1.75 qu. May 15
Construction Mat. com.	6- 2-30	17½	18¾	
Construction Mat. pfd.	6- 2-30	40	41	87½c qu. May 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[44]	5-29-30	92½	95	
Coosa P. C. 1st 6's[29]	6- 3-30	51½	53	
Coplay Cem. Mfg. 1st 6's[40]	6- 2-30	95	.....	
Coplay Cem. Mfg. com.[40]	6- 2-30	10	.....	
Coplay Cem. Mfg. pfd.[40]	6- 2-30	60	.....	
Dewey P. C. 6's (1942)	6- 3-30	98	.....	
Dewey P. C. 6's (1930)	6- 3-30	98	.....	
Dewey P. C. 6's (1931-41)	6- 3-30	98	.....	
Dolese & Shepard	6- 2-30	84	88	$2 qu. Apr. 1
Dufferin Pav. & Cr. Stone com.	6- 2-30	.....	20	
Dufferin Pav. & Cr. Stone pfd.	6- 2-30	.....	92	
Edison P. C. com.[39]	6- 2-30	10c	.....	
Edison P. C. pfd.[39]	6- 2-30	25c	.....	
Giant P. C. com.[2]	6- 2-30	7	11	
Giant P. C. pfd.[2]	6- 2-30	15	25	1.75 s.-a. June 16
Gyp. Lime & Alabastine, Ltd.	6- 2-30	22¾	22⅞	37½c qu. Apr. 1
Hermitage Cement com.[11]	6- 2-30	30	35	
Hermitage Cement pfd.[11]	6- 2-30	85	95	
Ideal Cement, new com.	6- 2-30	55	58	75c qu. Apr. 1
Ideal Cement 5's, 1943[33]	6- 2-30	97	99	
Indiana Limestone com.[29]	4-21-30	3	5	
Indiana Limestone pfd.[29]	4-21-30	No market		1¾% qu. June 1
Indiana Limestone units[29]	6- 3-30	75	85	
Indiana Limestone 6's	6- 2-30	84	.....	
International Cem. com.	6- 2-30	66	67½	$1 qu. June 27
International Cem. bonds 5's	6- 2-30	100½	.....	Semi-ann. int.
Iron City S. & G. bonds 6's	4-21-30	95	.....	
Kelley Is. L. & T. new st'k	6- 2-30	40	45	62½c qu. Apr. 1
Ky. Cons. St. com. V. T. C.[48]	5-29-30	9	11	
Ky. Cons. Stone 6½'s[48]	5-29-30	94	98	
Ky. Cons. Stone pfd.[48]	5-29-30	87½	90	1.75 qu. May 1
Ky. Cons. Stone com.[48]	5-29-30	9	11	
Ky. Rock Asphalt com.[11]	6- 2-30	15	17	40c qu. Apr. 1
Ky. Rock Asphalt pfd.[11]	6- 2-30	85	90	1.75 qu. Mar. 1
Ky. Rock Asphalt 6½'s[11]	6- 2-30	100	103	
Lawrence P. C.	5-29-30	57	63	$1 qu. Mar. 29
Lawrence P. C. 5½'s, 1942	5- 7-30	83	.....	
Lehigh P. C.	6- 2-30	36	38	62½c qu. May 1
Lehigh P. C. pfd.	6- 2-30	107½	108½	1¾% qu. July 1
Louisville Cement[7]	5-29-30	230	.....	
Lyman-Richey 1st 6's, 1932[13]	6- 2-30	97	99	
Lyman-Richey 1st 6's, 1935[13]	6- 2-30	97	99	
Marblehead Lime 6's[14]	5-31-30	90	95	
Marbelite Corp. com.	5-28-30	250	.....	
Marbelite Corp. pfd.	5-28-30	12½	.....	50c qu. Apr. 10
Material Service Corp.	6- 3-30	.....	22	50c qu. June 1
McCrady-Rogers 7% pfd.[22]	6- 2-30	50	.....	
McCrady-Rogers com.[22]	6- 2-30	20	21¼	
Medusa Portland Cement	6- 2-30	.....	96	1.50 Apr. 1
Mich. L. & C. com.[6]	6- 2-30	25	.....	
Missouri P. C.	6- 2-30	33	33½	50c qu. May 1
Monolith Portland Midwest[9]	5-29-30	2½	3	
Monolith bonds, 6's[9]	5-29-30	85½	87½	
Monolith P. C. com.[9]	5-29-30	3½	5	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	5-29-30	5	6	40c s.-a. Jan. 1
Monolith P. C. units[9]	5-29-30	13¼	16	
National Cem. (Can.) 1st 7's[43]	5-29-30	99½	.....	
National Gypsum A com.	6- 2-30	6	7	
National Gypsum pfd.	6- 2-30	35	38	
Nazareth Cement com.[26]	6- 2-30	24	.....	
Nazareth Cement pfd.[26]	6- 2-30	99	.....	
Newaygo P. C. 1st 6½'s[29]	6- 3-30	101½	.....	
New Eng. Lime 1st 6's[14]	5-31-30	95	98	
N. Y. Trap Rock 1st 6's	5-29-30	100½	101	
N. Y. Trap Rock 7% pfd.[36]	5- 5-30	95	.....	1.75 qu. Apr. 1
North Amer. Cem. 1st 6½'s	6- 3-30	62¾	.....	
North Amer. Cem. com.[29]	6- 3-30	2	4	
North Amer. Cem. 7% pfd.[29]	6- 3-30	26	32	
North Amer. Cem. units[29]	6- 3-30	28	34	
North Shore Mat. 1st 5's[15]	6- 3-30	95	.....	
Northwestern States P. C.[37]	5- 5-30	110	115	$2 Apr. 1
Ohio River Sand com.	6- 2-30	.....	17⅛	
Ohio River Sand 7% pfd.	6- 2-30	97	98	
Ohio River S. & G. 6's[16]	6- 2-30	85	90	
Oregon P. C. com.[9]	5-29-30	13	16	
Oregon P. C. pfd.[9]	5-29-30	95	100	
Pacific Coast Aggregates pfd.	5-26-30	.....	10½	
Pacific Coast Cement 6's[5]	3-20-30	80	85	
Pacific P. C. com.	5-29-30	.....	26	
Pacific P. C., new pfd.	5-29-30	80	85	1.62½ qu. Apr. 5
Pacific P. C. 6's	5-29-30	99½	.....	
Peerless Cement com.[21]	6- 2-30	8	10	
Peerless Cement pfd.[21]	6- 2-30	80	85	1.75 Apr. 1
Penn.-Dixie Cement pfd.	6- 2-30	45	49	
Penn.-Dixie Cement com.	6- 2-30	8½	9½	
Penn.-Dixie Cement 6's	6- 2-30	83½	.....	
Penn. Glass Sand Corp. 6's	5- 7-30	101	103	
Penn. Glass Sand pfd.	5- 7-30	110	.....	1.75 qu. Apr. 1
Petoskey P. C.	6- 2-30	9¼	10	15c qu. Apr. 1
Port Stockton Cem. units[9]	2-17-30	.....	30	
Port Stockton Cem. com.[9]	5-29-30	No market		
Riverside Cement com.	5-29-30	.....	14	
Riverside Cement pfd.[9]	5-29-30	78	82	1.50 qu. May 1
Riverside Cement, A[20]	5-17-30	11	15	31¼c Feb. 1
Riverside Cement, B[9]	5-29-30	4	5	
Roquemore Gravel 6½'s[17]	6- 2-30	99	100	
Santa Cruz P. C. 1st 6's, 1945[5]	3-20-30	105¾	.....	6% annually
Santa Cruz P. C. com.	5-29-30	91	.....	$1 qu. Apr. 1
Schumacher Wallboard com.	5-29-30	10	12½	
Schumacher Wallboard pfd.	5-29-30	21½	25	50c qu. May 15
Southwestern P. C. units[44]	5-29-30	250	.....	
Standard Paving & Mat. (Can.) com.	6- 2-30	21¾	22	50c qu. May 15
Standard Paving & Mat. pfd.	6- 2-30	87	90	1.75 qu. Feb. 15
Superior P. C., A	5-29-30	.....	38	27½c mo. June 1
Superior P. C., B	5-29-30	11¾	12	25c qu. Mar. 20
Trinity P. C. units[37]	5- 5-30	120	130	
Trinity P. C. com.[37]	5- 5-30	40	.....	
Trinity P. C. pfd.[29]	6- 3-30	107	.....	
U. S. Gypsum com.	6- 2-30	47½	49	40c qu. June 30
U. S. Gypsum pfd.	6- 3-30	115	121	1.75 qu. June 30
Universal G. & L. com.[3]	6- 3-30	No market		
Universal G. & L. pfd.[3]	6- 3-30	No market		
Universal G. & L., V. T. C.[3]	6- 3-30	No market		
Universal G. & L. 1st 6's[3]	6- 3-30	No market		
Warner Co. com.[16]	6- 2-30	44	48	50c qu. & 25c ex. July 15
Warner Co. 1st 7% pfd.[16]	6- 2-30	102	106	1.75 qu. July 1
Warner Co. 1st 6's (w. w.)	6- 3-30	99½	100	
Whitehall Cem. Mfg. com.[26]	5- 5-30	40	.....	
Whitehall Cem. Mfg. pfd.[26]	5- 5-30	48	.....	
Wisconsin L. & C. 1st 6's[15]	6- 3-30	95	.....	
Wolverine P. C. com.	6- 2-30	4¾	5¼	15c qu. May 15
Yosemite P. C., A com.[9]	5-29-30	2¾	3¼	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler Beadling & Co., Youngstown, Ohio. [5]Freeman, Smith & Camp Co., San Francisco, Calif. [6]Frederic H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago. Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simon & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [24]A. B. Leach & Co., Inc., Chicago, Ill. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Bank of Republic, Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago, Ill. [33]Boettcher Newton & Co., Denver, Colo. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Los Angeles, Calif. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co., Chicago, Ill.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
Atlantic Gypsum Products Co. 6's, 1941, $4,000 and 40 shs. com.[1]	35%	.....
Atlantic Gypsum Products 6's, 1941, $5,000; 50 shs. com. as bonus[3]	49%	.....
Consolidated Cem. com. v.t.c., 3220 shs.[1]	1½ per share	.....
Indiana Limestone deb. 7's, 1936, with warrants ($1,000)[4]	$500 for the lot	.....

[1]Price at auction by Wise, Hobbs & Arnold, Boston, Dec. 18, 1929. [3]Price at auction by R. L. Day & Co., Boston, Dec. 18, 1929. [4]Price at auction by Adrian H. Muller & Son, Dec. 26, 1929.

Warner Company Strengthens Financial Condition

A SPECIAL REPORT to stockholders of the Warner Co., Philadelphia, Penn., dated April 28, states in part:

It is approximately one year since the Warner Co. acquired the businesses and properties of the Charles Warner Co. and the Van Sciver Corp. A number of substantial changes, mostly by way of betterment, have occurred in the financial structure of the company during these first 12 months.

First—Through bond and preferred stock sinking fund operations and payments on purchase money contracts, the company has retired $1,366,620 of its underlying obligations, which has effected savings in interest and preferred stock dividend charges at the rate of $72,031 annually. Of the above, the largest single item is in the company's bond issue, on which a reduction of $623,000 has been effected against the initial issue of $7,000,000.

. *Second*—On April 1, 1930, the price at which warrants could be exercised for the purchase of common stock advanced from $40 to $45 per share. Prior to that date, 27,796 warrants were used to purchase common stock at $40 per share. This injected $1,111,840 in cash into the company's finances, one-half of which, according to the provisions thereof, was directly applied in the retirement of bonds and first preferred stock, according to sinking fund provisions. Hence, $555,920 of the amount applied to the total reductions of $1,366,620 came from the sale of new common stock, and the balance of said total retirement, amounting to $810,700, was supplied from cash accumulations in the operation of the business.

The above changes resulted in the retirement of about 7½% of the total obligations underlying the common stock, which was in part accomplished by the increase of about 13½% in the amount of common stock now outstanding as compared with one year ago.

Third—During this period the company has also expended, from cash accumulations in the first 12 months' operation of the business, a total of $1,114,917 in additional property purchases and plant improvements, most of which has been applied directly to earning investments through the development of further plant economies made possible by the consolidation and the expansion of profitable departments of the business.

The present outstanding common stock issue amounts to 230,796 shares. The number of common shareholders has increased from about 900 to about 1700 during the last 12 months, and this is also gratifying as showing a broader distribution and a larger public interest in the efforts of the company.

The company has passed through the first quarter of 1930 with satisfactory results, having covered all of its current charges for interest and preferred stock dividends during this lean quarter when building operations are at a minimum. This was estimated as a probability at the time of the merger for a normal winter quarter, and since business has been somewhat subnormal during the past winter, it is felt that the consolidated economies have well proven their value in this respect.

Boston Sand and Gravel Co. Balance Sheet

THE Boston Sand and Gravel Co., Boston, Mass., reports comparative balance sheets and earning statements for the year ended December 31, 1929, and November 30, 1928, as follows:

COMPARATIVE EARNINGS STATEMENT

	*1929	1928
Gross earnings	$1,286,509	$1,105,095
Operating expense and taxes	987,419	858,158
Depreciation	90,731	71,284
Depletion	23,070	20,182
Operating income	185,289	155,471
Interest	33,085	37,975
Net income	152,204	117,496
Preferred dividends	52,633	40,000
Common dividends	79,960	40,000
Surplus	$19,611	$37,496
Number of common shares	50,000	8,000

COMPARATIVE BALANCE SHEET

ASSETS

	§Dec. 31, 1929	*Nov. 30. 1928
†Plant and equipment	$2,517,888	$2,514,075
Current assets:		
Cash and securities	239,182	320,191
Inventories	11,662	4,208
Notes and accounts receivable	205,805	138,388
Deferred charges	25,875	.....
Total	$3,000,412	$2,976,862

LIABILITIES

Preferred stock	$ 817,850	$1,300,000
‡Common stock	1,517,733	1,241,720
Bonded debt	500,000	.....
Purchase money mortgage	70,450	65,000
Current liabilities:		
Accounts payable and accruals	94,379	55,975
Surplus	.....	314,167
Total	$3,000,412	$2,976,862
Current assets	$ 456,649	$ 462,787
Current liabilities	94,379	55,975
Working capital	$ 362,270	$ 406,812

*Giving effect to new financing, etc. †After depreciation and depletion. ‡Represented by 50,000 no par shares. §Consolidated statement, including Boston Concrete Corp.

Balance Sheet of Medusa Portland Cement Co.

THE consolidated balance sheet as of December 31, 1929, of the Medusa Portland Cement Co., Cleveland, Ohio, is:

ASSETS

Land, buildings, equipment, etc. (less depreciation)	$13,268,845
Investments	127,652
Cash	382,769
U. S. Government securities	35,310
Notes and accounts receivable (net)	643,991
Merchandise inventory	2,052,132
Life insurance, cash value	40,304
Deferred charges	298,986
Total	$16,849,989

LIABILITIES

Preferred stock	$ 293,600
*Common stock	6,215,226
Newaygo preferred stock	112,500
Minority interest (Crescent Co.)	34,878
Funded debt	3,519,600
Notes payable and mortgage	209,810
Accounts payable	241,525
Accrued taxes and interest	315,950
Dividends payable	272,778
Contingency reserve, etc.	307,587
Surplus	5,326,535
Total	$16,849,989
Working capital	$ 2,114,443

*Represented by 177,566 no par shares.

Kentucky Rock Asphalt Co. Balance Sheet

THE Kentucky Rock Asphalt Co., Louisville, Ky., reports comparative income statements and balance sheets for the years ending December 31, 1929 and 1928, as:

DECEMBER 31

	1929	1928
Net sales	$1,298,003	$1,517,446
Cost of sales	577,617	657,277
Expenses	199,626	217,114
Depreciation and depletion	106,804	148,216
Net revenue	413,956	491,839
Other income	(d)31,187	(d)16,677
Total income	382,769	475,162
Interest, etc.	67,307	89,440
Federal taxes	34,258	47,804
Miscellaneous charges	.....	12,000
Net income	281,204	325,918
Preferred dividends	91,322	91,322
Surplus	$ 189,882	Not stated
Earned per share, common	$1.50	$2.15
Number of common shares	126,793	108,873

ASSETS

	1929	1928
‡Plants and mineral rights	$5,093,889	$5,120,556
Current assets:		
Cash in banks	88,611	162,730
Accounts receivable (net)	390,057	531,424
Notes receivable		4,570
Inventories	422,824	352,195
Deferred charges, etc.	326,718	398,363
Total	$6,322,099	$6,569,838

LIABILITIES

Preferred stock	$1,304,600	$1,304,600
Common stock and surplus	†3,156,299	2,978,085
Bonded debt	1,235,500	1,428,500
Current liabilities:		
Accounts payable	48,504	134,881
Notes payable	50,000	150,000
Common dividends payable	.....	27,218
Accrued bond interest	5,679	6,724
Reserve for federal taxes	34,258	47,805
Reserve for insurance	21,849	19,449
Undivided profits	465,410	472,576
Total	$6,322,099	$6,569,838
Current assets	$ 901,492	$1,050,919
Current liabilities	138,441	366,628
Working capital	$ 763,051	$ 684,291

‡After depreciation and depletion: 1928, $364,426. †Represented by 126,793 17/40 no par shares.

Hawkeye Portland Cement Co. Balance Sheet

THE Hawkeye Portland Cement Co., Des Moines, Ia., reports for the calendar year ending December 31, 1929 and 1928:

ASSETS

	1929	1928
*Property and equipment	$1,521,600	$1,517,246
Stocks and bonds	5,300	9,850
Current assets:		
Marketable securities and cash	282,023	428,237
Inventories	457,827	416,421
Notes and accounts receivable	572,306	341,378
Prepaid items	4,974	5,262
Total	$2,844,030	$2,718,394

LIABILITIES

Capital stock	$2,168,175	$2,164,225
Current liabilities:		
Accounts payable	129,808	93,709
Reserve for taxes	135,240	127,640
Surplus	410,807	332,820
Total	$2,844,030	$2,718,394
Current assets	$1,312,156	$1,186,036
Current liabilities	265,048	221,349
Working capital	$1,047,108	$ 964,687

*After depreciation and depletion, 1929, $1,626,773; 1928, $1,525,162.

Recent Dividends Announced

Canada Cement pfd. (qu.)	1¾%, June 30
Giant P. C. pfd. (semi-ann.)	$1.75, June 16
Internat'l Cement com. (qu.)	$1.00, June 27
Warner Co. com. (qu.)	50c, July 15
Warner Co. com. (extra)	25c, July 15
Warner Co. 1st and 2nd pfd. (qu.)	$1.75, July 1

Foreign Abstracts and Patent Review

Process for Increasing Shaft-Kiln Output. The process described applies to shaft kilns with charge firing for burning lime, cement, dolomite, etc. Preheated air is supplied to the preheating zone, and cold air to the burning zone; a portion of the cooling air introduced at the kiln discharge is withdrawn beneath the burning zone. The cooling air is partly delivered directly to the stack, but partly supplied to the preheating zone as preheated air. By use of this new process, the cooling, burning and preheating zones can be separated from each other and can be treated individually as required.—German Patent 489,833.—*Tonindustrie-Zeitung* (1930) **54**, 17, p. 283.

Dust Collection in Foreign Quarries. To those who have seen a post mortem on the lung of a person who has died of fibrosis due to silicosis, and observed the leathery, fibrous mass of gray tissue, creaking and gritty under the knife, not unlike a sponge saturated with a mixture of treacle and pumice stone, the need of adequate dust collection need not be greatly stressed."

This paragraph is from "Dust in Quarries," an article in the (British) *Quarry Managers' Journal,* by one who signs himself Quarry Engineer. It not only gives some interesting facts about illness and death due to silica poisoning, but it includes a report of experiments made somewhere on the continent in collecting dust, which he witnessed. Three companies collaborated in making the tests, the expense being about $750. In all three the dust collected in five hours by settling anywhere in the plant was about the same, 1.63 oz. per square yard. This was taken as 100% in judging the work of the different collectors. The plant in which most of the tests were made had an output of 5000 tons per week. As these are presumably metric or long tons, the plant would rate in the United States at about 1000 tons per day capacity.

The tests were divided into experiments in getting the dust to the fan and collecting it from the fan. For the first a fan of 15,000 cu. ft. per minute was installed. The suction pipe was connected first to an 18-in. pipe 60 ft. long, with one 5-ft. radius bend, and 20 ft. of straight pipe with two 8-in. junctions set in at a narrow angle. Afterward the same arrangement was tried with a square trunk pipe, which offered some advantages, in the opinion of one engineer. But the round pipe proved better, as much less dust was deposited in it, because there were no corners in which eddy currents and dead spaces could form. (Figs. 1 and 2.)

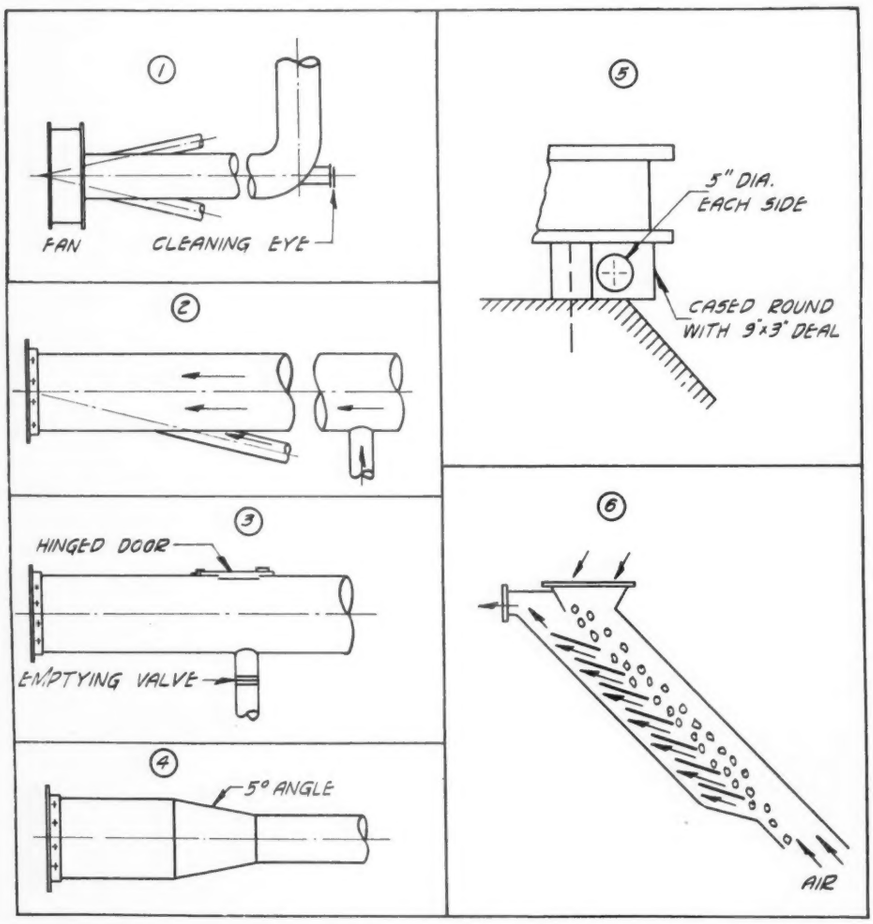
But there was some dust deposited even with the round pipe, and it was necessary to put in clean-out doors in the top of the pipe about every 8 ft. Pipes directly under these with simple valves served for removing the sweepings. (Fig. 3.)

Telescopic joints were cheaper but they were found to be a nuisance in cleaning and in making repairs and changes. It is recommended in the article to make the pipe in 8-ft. joints with flanges of 1¼x1¼-in. angle iron. In making reductions to a smaller pipe it was found that the cone of the reducing piece should have an angle of no more than 5 deg. (Fig. 4.)

Details of piping are left undescribed, as they varied in every plant. But the manner of enclosing the machine protected was: Gyratory crushers, completely hooded except for a 6 ft. opening on one side, and one 8-in. central draw-off pipe; jaw crushers, two 5-in. draff-off pipes below the jaw opening and a hood over the mouth with a 6-in. draw-off; rolls, hooded inside the gearing with a 6-in. draw-off above and an 8-in. draw-off below the rolls; screens, in hopper bottoms with light sheet metal tops; elevators, one 6-in. draw-off at the feed end and one at the delivery end. (Fig. 5.)

All chutes in the plant were closed in with double bottoms and sloping plates arranged so that the stone falls from one to the other, turning as it falls and being subjected to the action of a current of air all the time. The plates were made renewable. This appears to be an excellent method not only of disposing of the dust nuisance but of cleaning the stone. (Fig. 6.)

Fans of several types were tested and the multivane turbine type was preferred. On wet days trouble came from dust sticking to the fan blades, throwing the fan out of balance, causing heavy vibrations. The multivane turbine type had to be cleaned oftener than the others. On account of wear it was judged that fan casings should be easily removable.



Devices developed as the result of dust collecting experiments carried out by British quarry engineer

Collecting the Dust

A collecting test was made with four different collectors, but the paper gives no details of them, not even the types to which they belonged. The fan used had 20,000 cu. ft. per minute capacity and was driven by

a 20-hp. motor. A preliminary test, exhausting into the air, showed that the fan and piping would reduce the dust settling in the plant to 0.002 oz. in five hours.

The features on which the work of the collectors were to be judged were: (1) To collect all the dust delivered by the fan without any escaping, up to 20,000 cu. ft. of air per minute; (2) to entail the minimum of back pressure on the fan; (3) to need not more than 15 minutes per day attention; (4) to save the dust in its dry state so that it could be sold with no other expense than bagging; (5) to require no power installation; (6) to be of reasonable cost.

The tests came out as follows:

Collector	A	B	C	D
No. 1	80%	100%	100%	85%
No. 2	2nd	3rd	1st	4th
No. 3	All equal			
No. 4	3rd	2nd	1st	4th
No. 5	2nd	3rd	1st	4th
No. 6	4th	2nd	2nd	1st

Collector C was accepted. After permanent installation the dust settling on the floor averaged 0.003 oz. per square yard over six days. The collected dust sold for $2.40 per ton, equivalent.

The tests were made on dust from these rocks: Basalt, sp. gr., 3.02; quartzite, sp. gr., 2.65, and porphyrite, sp. gr., 2.75.

A mean velocity of 5100 ft. per minute was found best for all these, but protecting plates had to be put in the bends of the pipe in the case of the quartzite dust to prevent excessive wear.

It was found that long pipes between the fan and the collector should be avoided. A cyclone placed before the fan reduced the dust the fan had to handle by 30% (and the most abrasive portion). Pipes, it was found, should not be placed so that the dust has to be lifted considerably under suction. It is better to blow it under pressure to the height required. In a scattered plant it is inadvisable to use long suction pipes and a single fan. Better results are obtained by several units. The article says in closing:

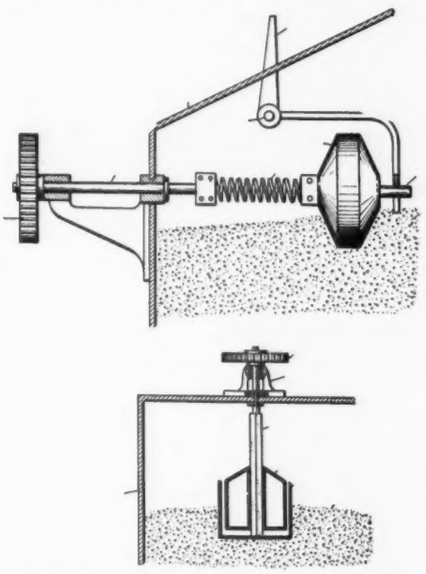
"There is no part of a quarry that more money can be spent upon in experiments than in dust collecting, and in many cases it is wasted through not tackling the matter fully and completely from the start."

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Indicating Device for Level of Pulverulent Material in Bins. In the handling of pulverulent material, such as cement, it is oftentimes desirable to indicate the level of such material in a bin or other container. If a body is supported upon the material it has been found that the indication as to the level of the material is unreliable because such body or float does not respond quickly to changes in level and may even become completely buried in the material without change of level.

In the attempt to overcome this difficulty and to provide a reliable means of indicating the level of such material it has been found that the float is quickly responsive to changes in level if there is imparted to the material in the immediate vicinity of the float a condition of fluidity. This is most conveniently accomplished by agitation of the material about the float as, for example, by a mechanical agitating means which may be independent of the float; or a means for imparting such movement to the float itself that the material will be agitated or have imparted to it a condition of fluidity. Thus, for example, the means for agitating may be means for causing the float to rotate about its own axis while permitting it to rise or



A horizontal and vertical device for indicating level of material in bins

fall with the level of the material, or a device external to the float so actuated as to agitate the material about the float while being free to rise and fall with the float.

The accompanying illustrations show how the inventors of this patent provide for rotation of the float by belt or gear drives.—*Kristian Middleboe, Assignor to F. L. Smidth & Co.*, U. S. Patent No. 1,714,515.

Building Cement or Plaster. This invention relates to producing building cement or plaster very cheaply and which possesses excellent qualities with regard to plasticity and set. The material which is developed in the process is called "Krauscake" and is a product in which the base is an aluminous earth or mineral matter, such as clay, kaolin, diaspore, cyanite, bentonite, feldspar, bauxite, etc. (materials containing 12% or more of alumina) together with other substances necessary to give the desired results. There may be also suitably added to the mixture, to produce certain desired results alunite, high alumina slag, blast furnace slag, cryolite, etc., as indicated by the following tables.

The process may be illustrated as follows: The aluminous earth as, for instance, clay is roasted at a temperature below that which would drive off all the combined water, allowing 20% or less of such water to remain, and upon the addition of alkaline earths, digested with sulphuric acid and water, and after the ingredients have reacted, further water is added to form a slurry. The addition of alkaline earths to material containing the alumina causes colloidal or finely divided alumina to be formed. The silica assumes a colloidal form upon separation from the alumina so that the originally combined silica as well as the alumina are obtained in the colloidal state. The alkaline earths may be added to the roasted clay, digested with sulphuric acid in the slurry referred to or this slurry may be formed without the addition of alkaline earths and the alkaline earths added later. In carrying out the process the clay or like material is digested with sulphuric acid as described in the presence of water which produces the material known as Krauscake and then sufficient water is added (as will appear from the tables below) to form a slurry. This is an example of what is called slurry A.

To this slurry A may then be added suitable alkaline earths, the mixture then forming slurry B and the resulting colloidal content being attained. Thus according to formula No. 1 of the slurry A table, no alkaline earth is added to the slurry. When, however, this slurry has had added to it an alkaline earth as, for instance, calcium hydroxide as shown by slurry B formula No. 1, the colloidal content of the alumina as referred to above is obtained. According to formula No. 2 of the slurry A table, alkaline earth, namely, high calcium limestone, is added in the slurry A and further alkaline earths may be added according to the various formulas in the slurry B table, resulting in the desired colloidal content of the alumina, and any originally combined silica which may have been present with the clay. The essential thing is that the clay or other equivalent aluminous material, roasted as described and digested with sulphuric acid, shall be treated with alkaline earth either in the slurry A or when the slurry B is formed. When alkaline material is added in the slurry A, a highly activated calcium sulphate is produced which is believed to be of advantage in some cases, but it is not of great importance whether the alkaline earth is digested with the materials in forming the Krauscake or is added when the slurry B is formed.

External heat may be applied to hasten the reactions.

Materials containing alkaline earths, suitable for use in the above process include dolomitic limestone, calcium hydroxide, calcium oxide, portland cement, marl, etc. Also such substances as alunite, cryolite, high calcium slag, blast furnace slag and other substances may be used as indicated in the tables following.

The slurry B (which consists of slurry A to which are added various ingredients as

illustrated by the formulas in the slurry B table) may be roasted or more alkaline earths may be added to the slurry B, such roasting being according to the material desired, and in either case a product will be produced which, when mixed with water, will have good plasticity, set and strength.

Examples of slurries A and B are as follows:

SLURRY A
(Parts by Weight)

	Sulphuric acid	Water	Roasted clay	Bentonite	Alunite	Cryolite	High calcium limestone	Dolomitic limestone	Bauxite	Blast furnace slag	(H_2O water to form slurry)
Formula No. 1	100	120	100	.....	.....	.....	.....	.....	.....	.....	480
Formula No. 2	132	120	100	5	.....	.....	20	.....	.....	.....	480
Formula No. 3	136	120	100	.....	20	.....	.....	.....	.....	.....	480
Formula No. 4	136	120	100	10	.....	20	.....	.....	.....	.....	480
Formula No. 5	136	120	100	.....	.....	.....	.....	20	.....	.....	480
Formula No. 6	136	120	100	5	.....	.....	.....	.....	20	.....	480
Formula No. 7	136	120	100	20	.....	.....	.....	.....	.....	.....	480
Formula No. 8	132	120	100	.....	.....	.....	.....	.....	.....	.....	480
Formula No. 9	132	120	100	.....	.....	.....	.....	.....	.....	20	480

SLURRY B
(Parts by Weight)

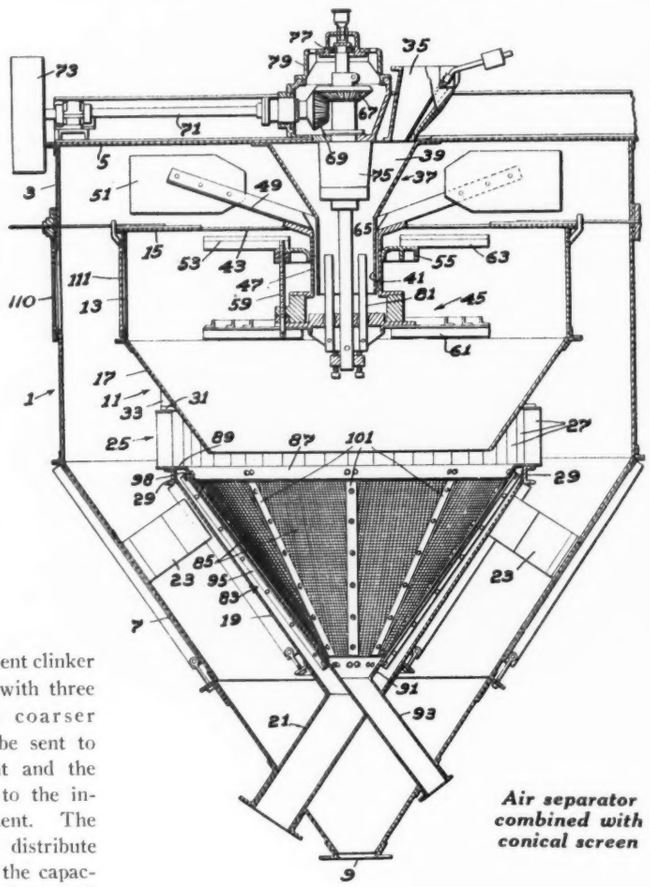
	Dry weight "Slurry A"	Calcium oxide	Calcium hydroxide	Gypsum rock	Portland cement	Burned dolomitic limestone	Marl	Dolomitic limestone	High calcium limestone	Barytes
Slurry B 1	100	.....	100	.....	.....	.....	.....	.....	100	.....
Slurry B 2	100	100	.....	100	.....	.....	.....	.....	.....	.....
Slurry B 3	100	.....	100	100	.....	.....	.....	.....	.....	.....
Slurry B 4	100	100	.....	100	.....	.....	.....	.....	100	.....
Slurry B 5	100	.....	.....	.....	10	.....	.....	5	100	.....
Slurry B 6	100	100	.....	.....	.....	.....	100	.....	.....	.....
Slurry B 7	100	.....	.....	100	.....	.....	.....	5	100	.....
Slurry B 8	100	.....	.....	.....	.....	.....	.....	.....	.....	200
Slurry B 9	100	.....	.....	.....	.....	100	.....	.....	.....	.....

With regard to roasting, entirely different quick setting products are produced by varying the temperature. Where a high percentage of sulphates are present a roasting temperature of 250 deg. F to 450 deg. F. gives a quick "flash" set. As the temperature is raised the "set" is retarded. Where a high percentage of calcium hydroxide is present in the mixture the best results are obtained by roasting at a temperature of 400 to 600 deg. F.

When extreme plasticity is desired, sufficient calcium oxide may be added to "slurry B" to take up the free water, which reaction generates sufficient chemical heat for partial dehydration of the sulphates; this heat ranges from 212 to 400 deg. F.

In producing the Krauscake, it has been found that by slightly "causticizing" the aluminous earth or mineral matter by adding caustic soda solution, or similar alkali solution, ranging from a strength of ½% to 5%, before roasting, the reaction is hastened. This, however, is not necessary.—*C. E. Krause, U. S. No.* 1,747,551.

Combining Air Separation with Screening. The combination of an air separator of a well known type with a conical screen contained within the separator permits the oversize product of the separator to be divided into coarse and fine products. The inventor states that it is especially adapted to the grinding of cement clinker in tube or ball mills with three compartments. The coarser screen product may be sent to the first compartment and the finer screen product to the intermediate compartment. The effect claimed is to distribute the load so that both the capacity and the efficiency of the mill are increased.



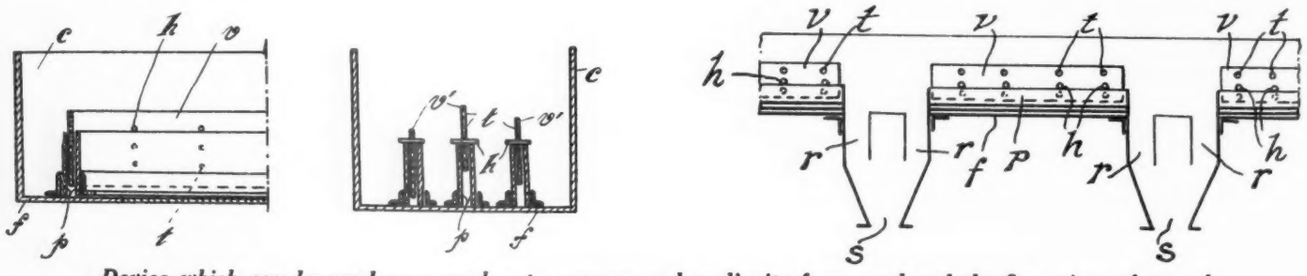
Air separator combined with conical screen

The material rejected by the air separator is passed over the screen with a whirling motion imparted by the vanes above, which are an essential part of the air separator. Because of this whirling motion the particles impinge on the screen fabric tangentially and this allows a coarser mesh than the size wanted to be used. The inventor states that a 6-mesh or 8-mesh screen may be used to make a 20-mesh product, as an example of its work.—*Thomas J. Sturtevant, U. S. No.* 1,735,479.

Stucco Mixer. This invention relates to improvements in stucco mixers, and more particularly to an apparatus for mixing stucco or calcined gypsum in a dry powdered state with water or other ingredients required to form the wet plastic mix from which various gypsum products are made.

The method of mixing consists of directing a stream of dry material in finely divided form by an air blast into a mix receiver, directing a spray of liquid toward the receiver and intersecting the stream of dry material and air before it enters the receiver, and thereafter kneading and treating the wet mix in the receiver.—*Sidney C. Clark, Assignor to American Gypsum Co.,* U. S. Patent No. 1,747,466.

Separator for Coal or Lignite. Although intended as a coal washer the device shown should be an excellent washer to remove coal or lignite from sand and the finer sizes of gravel. It is a combination of pockets to



Device which can be used as a washer to remove coal or lignite from sand and the finer sizes of gravel

catch the heavy solids, while the light solids flow over, and longitudinal riffles. These riffles effect stratification and have been used for that purpose in flumes for separating placer gold and other heavy products. The pockets should be provided with hydraulic water currents for use in gravel and sand washing.—*A. France,* U. S. No. 1,731,410.

Continuous Calcining of Gypsum. This invention has to do with the calcination or decomposition of materials that may be broken down by the heat, and is not limited to gypsum. In a previously filed application, Serial No. 53,478, filed August 31, 1925, the author describes a method and apparatus whereby gypsum or other material may be continuously heat treated and gypsum may be continuously calcined, the method described including characteristically the mobilization and moving of the gypsum through a comparatively long calcining chamber by the use of a hot mobilizing gas and preferably by the use of superheated steam. The application also describes the separation of the gypsum from the mobilizing steam or gas, and the water vapor evolved by calcination, before final cooling of the gypsum. Further it describes certain features of apparatus and mechanism adapted for such a method.

The present invention has particularly to do with improvements and extensions upon the method and apparatus, by the preheating of gypsum in a calcining kettle or the like, the generation of steam during that preheating, which is carried to the point of partial calcination, and driving off of water vapor, and the use of that steam for the purpose of heating and mobilizing the same gypsum for carrying it through the final part of its calcination.

In the drawings the single figure is a diagrammatic representation of an apparatus suitable for carrying out this method.

The method of calcining gypsum by preheating raw gypsum to temperatures below final calcining temperatures whereby substantial amounts of moisture are driven off in the form of saturated steam, superheating the steam and, by means of this superheated steam, both moving the preheated gypsum through a calcining zone and simultaneously calcining the gypsum, is a novel procedure. Another novel feature is the use of spiral conveyors of varying pitch so as to form a plug of gypsum and thus maintain any desired pressure in the calcining chamber.—*Alva W. Tyler, February* 11, 1930, *U. S. Patent No.* 1,746,294.

Apparatus and Process for Making Cement. The patentee describes a process and apparatus for utilizing waste dust in a cement mill by reintroduction into the slurry line. Referring to the drawing: The upper conveyor shown receives the lime slurry which delivers to a mixing hopper where additional water can be added. The contents of the mixing box pass tangentially to a centrifugal cone that serves a second mixing conveyor. The contents of the second conveyor may be sent to the kilns or returned to the mixing system for additional agitation.—*John E. Velsy and Walter T. Groner, Assignors to Southwestern Portland Cement Co.,* U. S. Patent No. 1,714,060.

Increasing Strength of Gypsum Products. The patentee describes his method of adding fiber or other bond making fillers in gypsum tile or wallboard which consists of first soaking the fiber in a suitable liquid and adding gypsum stucco until the desired pasty condition has been reached. The amount of fiber recommended approximates 5% of the gypsum used.

The author points out that when sawdust or other fillers are used they soak up an excessive amount of water and the gypsum immediately in contact with this slow drying absorbative is imperfectly crystallized and deficient in strength. By first soaking the filler in the liquid (not named) this property is overcome and a stronger, more durable tile or wallboard is secured. *Joseph F. Haggerty, Assignor to National Gypsum Co. U. S. Patent No.* 1,702,965.

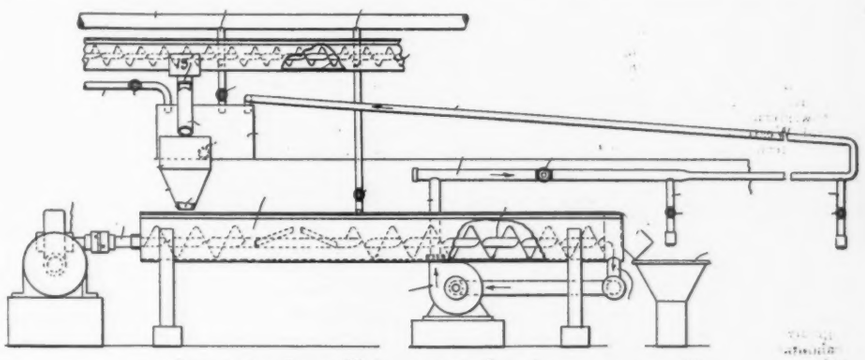
Waterproof Cement. This invention relates to a method of waterproofing cement which imparts to the resultant cement mixture increased strength and plasticity.

In the manufacture of waterproof cement, various agents may be used, as petroleum, coal tar, tallow and like substances. It is common practice to add these substances, either alone or in combination, to the cement during or after manufacture; generally a residual petroleum oil or fatty acids is used.

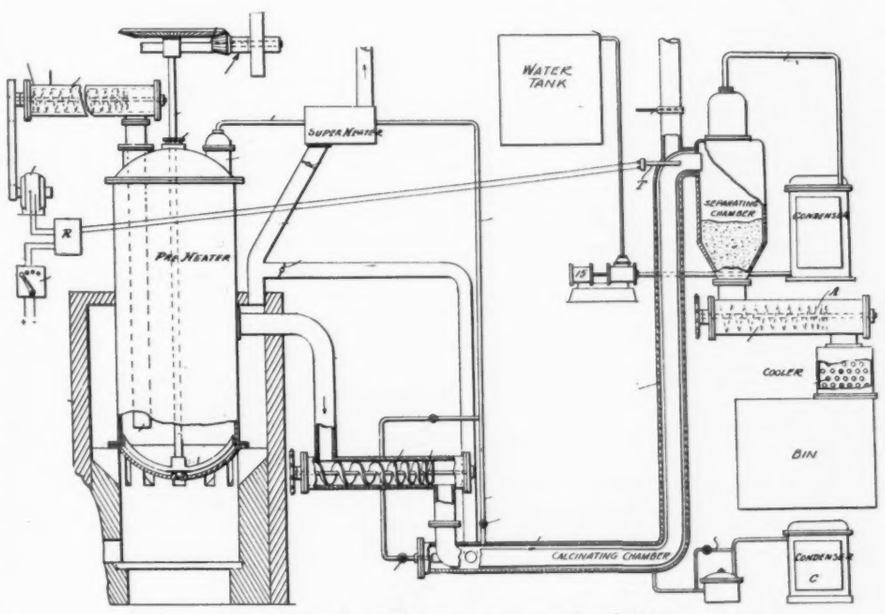
The author has found that only small quantities of such waterproofing agents can be added to cement without causing a decrease in the tensile strength of the resultant cement mixture. Also such agents lose their efficiency.

In refining petroleum oil, where the same is filtered and decolorized, using an active or activated adsorbent clay, the components of the petroleum or its fractions which are removed through the action of the clay, consists of asphaltic and resinous substances, which are in part, polymerized products, and which are in part not soluble either in oil or water.

This material, when added to the cement, increases its tensile strength and gives the desired waterproofing effect. *John M. Evans, April* 22, 1930; *U. S. Patent No.* 1,755,638.



Apparatus for utilizing waste dust in a cement mill



Cross-section view of continuous process of calcining gypsum

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

	Limestone flux—Week ended—		
District	April 26	May 3	May 10
Eastern	3,185	3,168	3,539
Allegheny	2,842	2,700	3,233
Pocahontas	479	561	625
Southern	887	806	756
Northwestern	739	1,023	1,601
Central Western	476	536	476
Southwestern	579	572	500
Total	9,187	9,366	10,730

	Sand, stone and gravel—Week ended—		
District	April 26	May 3	May 10
Eastern	6,952	8,710	10,122
Allegheny	6,178	7,226	7,816
Pocahontas	1,311	1,651	1,684
Southern	8,780	9,056	8,511
Northwestern	4,561	5,887	5,817
Central Western	11,512	11,390	11,178
Southwestern	7,935	7,179	7,132
Total	47,229	51,099	52,260

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1929 AND 1930

	Limestone Flux		Sand, Stone and Gravel	
	1929	1930	1929	1930
	Period to date		Period to date	
District	May 11	May 10	May 11	May 10
Eastern	50,633	45,822	83,950	70,763
Allegheny	57,284	45,399	68,950	71,178
Pocahontas	5,539	5,683	9,929	15,824
Southern	8,710	12,535	141,007	128,665
Northwestern	14,810	13,429	50,273	40,868
Central Western	9,663	9,026	127,815	134,951
Southwestern	8,046	7,377	99,052	98,669
Total	154,685	139,271	580,976	560,918

COMPARATIVE TOTAL LOADINGS, 1929 AND 1930

	1929	1930
Limestone flux	*154,685*	*139,271*
Sand, stone, gravel	*580,976*	*560,918*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning May 31:

SOUTHERN FREIGHT ASSOCIATION DOCKET

50406. **Sand and gravel,** from Ellerslie and Warmore, Va., to South Hill, Va. Present rate, 121c per net ton. Proposed rate on sand and gravel, carloads (See Note 3), from and to above named points, 115c per net ton. Based on the scale prescribed by the Interstate Commerce Commission in Docket 17517 and related cases.

50408. **Calcite, ground or pulverized limestone,** from Sparta and Doyle, Tenn., to Trenton, N. J. Present rate, 748c per ton of 2240 lb. Proposed rate on calcite, viz.: Limestone, ground or pulverized, carloads, minimum weight 67,000 lb., except where marked capacity of car is less, in which event marked capacity of car will be the minimum weight, from and to above named points, 623c per net ton (which is 709c per ton 2240 lb.). The proposed rate is the same as rate in effect from Sparta, Tenn., to Jersey City, N. J.

50417. **Sand, gravel and crushed stone,** from Norfolk, Va., to Norfolk Southern R. R., Beaufort Division stations. It is proposed to publish rates on sand, gravel and crushed stone, carloads, minimum weight 100,000 lb. (when 90% of marked capacity of car is less than 100,000 lb., such 90% of marked capacity will apply as minimum), except when cars are loaded to their visible capacity the actual weight will govern, from Norfolk, Va., to points on the Beaufort Division of the N. S. R. R. between New Bern, N. C., and Beaufort, N. C. Proposed rates to representative points are as follows (in cents per net ton):

Newport, N. C.	160
Morehead City, N. C.	160
Beaufort, N. C.	160

50422. **Sand,** from Crossley, Fla., to New Castle, Penn., Detroit, Mich., and Ohio destinations. It is proposed to establish the following reduced rates on sand (See Note 3) from Crossley, Fla.: To New Castle, Penn. 660c; Akron, O., 593c; Steubenville, O., 663c; Cleveland, O., 593c; Canton, O., 593c; Columbus, O., 533c; Alliance, O., 593c, and Detroit, Mich., 585c per net ton.

50432. **Crushed stone,** from Klotz and Longcor, Va., to Edgerton, South Hill, Pleasant Shade, Dodamead and Midlothian, Va. It is proposed to establish the following reduced rates on stone, crushed, carloads (See Note 3), but in no case shall minimum weight be less than 90,000 lb., from Klotz and Longcor, Va.: To South Hill and Edgerton, Va., 160c; Pleasant Shade, 170c; to Dodamead and Midlothian, Va., 150c per net ton. Proposed rates are based on joint line scale prescribed in I. C. C. Docket 17517.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

50439. **Sand, gravel, crushed stone, slag,** etc., from southern points to Flemingsburg, Ky. It is proposed to cancel all rates on sand, gravel, crushed stone, slag, etc., published in Agent Glenn's F. T. 88A, I. C. C. A655, to Flemingsburg, Ky., and at the same time provide for the application of the joint Trunk Line scale (Scale No. 2, page 244), in Agent Glenn's I. C. C. A655, from all origins to Flemingsburg, Ky.

50471. **Crushed stone,** from Anna, Ill., Cerulean (Nicholson) and Cedar Bluff, Ky., to Dresden, Tenn. Combination rates now apply. Proposed rate on **stone, crushed or broken, stone screenings or stone, refuse** (not ground or pulverized stone) carloads (See Note 3), from the above named origins to Dresden, Tenn., 125c per net ton, based on Docket 17517 scale, using the distance from Cerulean (Nicholson), Ky.

50486. **Limestone poultry grit,** from Barber, Va., to southern points. In lieu of class rates it is proposed to establish commodity rates on limestone, poultry grit, in bags, carloads, minimum weight 50,000 lb., from Barber, Va., to points of destination in Southern Freight Association territory named in Agent Cottrell's I. C. C. 751 on basis of 15% of the first class rates.

50497. **Sand, gravel, stone, etc.,** from Paducah, Ky., to G. M. & N. R. R. (Dyersburg Branch) stations. It is proposed to establish the following reduced rates on sand, gravel, stone, etc., as described in Agent Glenn's I. C. C. A-655, from Paducah, Ky.: To Parkers, Tenn., $1.15; to Tigrett, Friendship, Maury, Crockett Mills, Nichols, Alamo, Bells and Brittain, Tenn., $1.25 per net ton. Made on basis of the I. C. C. Docket 17517 standard line scale.

50550. **Crushed stone,** from Alco, Blue Ridge, Lynchburg, Miles, Pembroke, Pekin, Ripplemead, Roanoke and Rostoco, Va., to Dodamead, Midlothian, South Hill, Edgerton and Pleasant Shade, Va. It is proposed to establish rates on stone, crushed, carloads (See Note 3), but in no case less than 90,000 lb., from and to above mentioned points, on basis of Docket 17517 scale for distance via N. & W. Ry., Burkeville, Va., and Southern Ry. Statement of the present and proposed rates will be furnished upon request.

50552. **Crushed gravel,** from East St. Louis, Ill., to Port Wentworth and Savannah, Ga. In lieu of Evansville, Ind., combination, it is proposed to establish through rate of $3.65 per net ton on crushed gravel, carloads (See Note 3), from East St. Louis, Ill., to Port Wentworth and Savannah, Ga. Made with relation to rate suggested under Submittal 50028 to Atlanta, Ga.

50626. **Crushed stone, etc.,** from Krause and Columbia Quarry No. 2, Ill., to Dresden, Tenn. In lieu of combination it is proposed to establish rate of 150c per net ton on stone, crushed or broken, stone screenings or stone refuse (not ground or pulverized stone), (See Note 3), carloads, from and to points mentioned, 150c per net ton. Made on basis of I. C. C. Docket 17517 scale, using the distance from **Krause, Ill.**

50638. **Ground phosphate rock, etc.,** from Florida mines to Quincy, Ill. In lieu of combination rate, it is proposed to establish through rate of 837c per ton, 2240 lb., on ground phosphate rock, carloads, usual description and minimum weight, from Florida mines named in A. C. L. R. R., I. C. C. B2606, and S. A. L. Ry., I. C. C. A7329, to Quincy, Ill., made in line with rates to other points in C. F. A. and I. F. A. territories.

50655. **Molding sand,** from Tell City, Ind., to Memphis, Tenn. It is proposed to establish reduced rate of 225c per net ton on sand, molding (See Note 3), from Tell City, Ind., to Memphis, Tenn. Same as rate from Evansville, Rockport and Troy, Ind.

TRUNK LINE ASSOCIATION DOCKET

23579. **Crushed stone,** carloads (See Note 2), from LeRoy, N. Y., to Bradford and Lewis Run, Penn., $1.05 per net ton. Present rate, $1.15 per net ton. Via Erie R. R. direct. Reason—Proposed rate is same as now in effect via B. R. & P. Ry.

23592. (A) **Sand,** other than blast, engine, foundry, molding, glass, silica, quartz or silex and/or **gravel,** carloads; (B) **sand, blast, engine, foundry, molding, glass, silica, quartz or silex,** carloads (See Note 2), from Lewes, Del., to Temple, Penn. (A) $1.95 and (B) $2.20 per net ton. Reason—Proposed rates are comparable with rates from Cape May, N. J., to Temple, Penn., and from Lewes, Del., to New Brunswick, Perth Amboy and Jersey City, N. J.

23606. **Stone, viz., fire, ganister,** carloads (See Note 2), from Barree, Brookes Mills, Hannah, Mt. Union, Reedsville and Wolfsburg, Penn., to Hamilton, Ont., 18½c per 100 lb. (Present rates are class rates.) Reason—Proposed rate is comparable with rates from Berkeley Springs, Hancock, W. Va., etc.

23620. **Sand, viz., engine, glass, common, etc., and flint, ground,** as per Item 6385C of Agent Curlett's Tariff I. C. C. A265, observing the same minimum weight as shown in this item (rates per net ton):

From	Prop.
Berkeley Springs, W. Va., to Cincinnati, O.	$3.30
Great Cacapon, W. Va., to Cincinnati, O.	3.30
Hancock, W. Va., to Chillicothe, O.	2.90
Cumberland, Md., to Chillicothe, O.	2.90
Triplett, Va., to Cincinnati, O.	*3.40
Triplett, Va., to Chillicothe, O.	*3.00

*Glass sand only.

Reason—Proposed rates are fairly comparable with rates from the Berkeley Springs-Cumberland district.

23622. **Crushed stone,** carloads (See Note 2), from J. C. Stahl, Penn., and Beavertown, Penn., to Berwick, Penn., $1.30 per net ton (present rate $1.40 per net ton). Reason—Proposed rate is comparable with rate from Beavertown to Trout Run, Ralston, Bodine, Penn., etc.

23074. **Sand and gravel,** carloads (See Note 2), from all stations on the Raritan River, and Pinewald, Quail Run and Toms River, N. J., to Ramapo, N. Y., $2.25 per net ton, in open top equipment and $2.47 per net ton in box cars.

23632. **Crushed stone,** carloads (See Note 2), from White Haven, Penn., to Benton, Penn., $1.45 per net ton (present rate $2.05 per net ton). Reason—Proposed rate is based on Birdsboro Stone Scale I. C. C. 9532.

23635. **Sand and gravel,** carloads (See Note 2), from Kenvil, N. J., to Glen Gardner, N. J., 75c per net ton (present rate 81c per net ton). Reason—To meet motor truck competition.

23637. **Crushed stone,** carloads (See Note 2), from Jamesville, N. Y. Rates per net ton.

To	Prop.	Pres.
Suffern, N. Y.	$2.05	$1.75
Lackawaxon, Penn.	1.95	2.05
Mast Hope, Penn.	1.95	2.05
Skinners Falls, N. Y.	1.80	2.05
Stockport, N. Y.	1.70	1.85
Hales Eddy, N. Y.	1.60	1.85
Lanesboro, Penn.	1.45	1.50

Reason—Proposed rates compare favorably with rates to Carthage, Ashwood, Tivoli and Staatsburg, N. Y.

23642. **Glass sand**, carloads (See Note 2), from Tatesville, Penn.:

To	Prop.	Pres.
Morrisville, Penn.	240	306
Camden, N. J.	240	279
Trenton, N. J.	240	306
Lambertville, N. J.	260	288
New Brunswick, N. J.	260	342
Old Bridge, N. J.	260	27½
Frenchtown, N. J.	260	288
Matawan, N. J.	280	32½

Proposed rates in cents per 2000 lb.

Reason—Proposed rates are fairly comparable with rates from Berkeley Springs, W. Va., to same points of destination.

23650. **Sand and gravel**, other than blast, engine, foundry, glass, molding, or silica, carloads (See Note 2), from Alfred, N. Y., to Shongo, N. Y., $1.10 per net ton. Present rate $1.30 per net ton. Reason—To meet motor truck competition.

23651. **Sand**, other than blast, engine, fire, foundry, glass, molding, quartz, silex and silica, **and gravel**, carloads (See Note 2), from Kenvil, N. J., to Mauch Chunk, Penn., $1.25 per net ton. Present rate, $1.60 per net ton. Reason—Proposed rate is comparable with rates to Weissport, Penn.

23661. **Sand**, other than blast, engine, foundry, glass, loam or molding, **and gravel**, carloads (See Note 2), from Wells Pit and New Martinsville, W. Va., to points in western Pennsylvania and eastern Ohio, West Alexander, Washington, Rand, Penn., Bellaire, Bridgeport, Flushing, Belmont, Barnesville, O., and various. Rates ranging from 70c to $1 per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

23665. **Gravel and sand**, other than blast, core, engine, fire, glass, grinding, molding, quartz, silex and silica, carloads, from Springville, N. Y., to Bolivar, Ceres, Prosser, Portville, Weston, N. Y., State Line and West Eldred, Penn., $1.15 per net ton. Present rate, $1.25 per net ton. Reason—Proposed rate is comparable with rates from Machias, N. Y.

M-1429. **Crushed stone**, carloads (See Note 2), from Suffern, N. Y., to Bogota, N. J., 60c per net ton. (Present rate, $1.05 per net ton.)

23672. **Trap rock, mine rock, broken stone, crushed stone and stone screenings**, in bulk, carloads (See Note 2), from Jamesville and Rock Cut, N. Y., to Syracuse, N. Y., 38c per net ton. (Present rate, 55c per net ton.) Reason—To meet motor truck competition.

23673. To increase rate of 90c to $1.10 per net ton on **sand, gravel, slag, etc.**, as described in B. R. & P. Ry. Tariff I. C. C. 8234, taking commodity Group "B" from Pittsburgh, Penn., to Shelocta, Penn. Reason—Proposed rate is comparable with rates from Pittsburgh, Penn., to Sykesville, Rossiter and Grace Siding, Penn.

23674. **Sand and gravel**, carloads (See Note 2), from Raritan River R. R. points to Danville, Penn., $2.50 per net ton, in open top equipment and $2.77 per net ton in box cars. Reason—Proposed rate is same as in effect from Lumberton, Birmingham and Pemberton, N. J.

23678. **Crushed stone**, carloads (See Note 2), from Honey Creek, Shraders and Naginey, Penn., to Mifflin, Penn., 75c, and South Danville, Penn., $1.15 per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

23680. **Sand**, carloads (See Note 2), from Birmingham and South Pemberton, N. J., to Smithville, N. J., 40c per net ton. To expire December 31, 1930. (Present rate 69c per net ton.) Reason—Proposed rate is comparable with rates on like commodities between points in same territory.

23717. **Crushed stone**, carloads (See Note 2), from Havre de Grace, Md., to Providence, Md., 70c per net ton. (Present rate, 90c per net ton.) Reason—Proposed rate compares favorably with rates to Barksdale, Md., and Newark, Del.

23719. **Broken stone**, carloads, from Port Deposit, Md., to Longport, N. J., $1.85 per net ton. (Present rate, $2.20 per net ton.) Reason—Proposed rate is comparable with rates from Port Deposit, Md., to Atlantic City and Margate City, N. J.

23722. To establish rates on **crushed limestone, poultry grit**, in bags, carloads, minimum weight 40,000 lb., from Barber, Va., to points in C. F. A. territory as shown in W. K. Weisinger's I. C. C. 146 taking rate reference No. 60 to 120A, on basis of 2½ per 100 lb. over the rates on crushed oyster shells, carloads, as shown under Rate Basis No. 155 of Agent Weisinger's Tariff I. C. C. 160. Rates to representative points as follows:

Rates in cents per 100 lb.	Prop.
Cleveland, O.	28
Cincinnati, O.	28
Grand Rapids, Mich.	29½
Indianapolis, Ind.	29½
Chicago, Ill.	32
Bloomington, Ill.	35½
St. Louis, Mo.	37½

23720. **Sand**, carloads (See Note 2), from Tom River, N. J., to Whitings, N. J., 60c per net ton. Rate to expire December 31, 1930. (Present rate, 81c per net ton.) Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions within this same general territory.

23725. To establish rates on **limestone, unburnt, ground**, carloads, minimum weight 50,000 lb., from Carmine, Va., to eastern points as named in C. & O. Ry. I. C. C. 10896, on same basis as now in effect from Barber, Va., to eastern points as named in aforementioned tariff.

WESTERN TRUNK LINE DOCKET

7269. **Rock silica, crushed**, carloads, minimum weight 60,000 lb., from St. Clair, Mo., to St. Charles, Mo. Rates—Present, class rates; proposed, establish rate of $1.33 per net ton.

2556-P. **Sand, silica**, carloads (See Note 2), but not less than 40,000 lb., from Bay City, Wis., to Rockford, Ill. Present rate $2.40 per net ton, proposed rate $1.90 per net ton; from Bay City, Wis., to Charles City, Iowa, present rate $2.40 per net ton, proposed rate $2 per net ton.

7235. **Sand**, carloads (See Note 3), but in no case shall the minimum weight be less than 40,000 lb., from Berlin, Browntown, Milwaukee, Portage and Rush Lake, Wis., to Aladdin, Ia. Present rates, 12c per 100 lb.; proposed, 11c per 100 lb.

1564-Y. **Stone, crushed**, usual minimum weight, from Dell Rapids, S. D., to Creston, Iowa, via Sioux City, Iowa, and C. B. & Q. R. R. Docket Advice No. 1564-Y listed in Docket Bulletin No. 2674, dated April 12, 1930, is hereby withdrawn at the request of the proponent.

7270. **Stone, crushed (granite)**, carloads (See Note 2), but not less than 40,000 lb., from Ablemans, Devil's Lake, North Freedom and Rattlesnake, Wis., to Keokuk and Ft. Madison, Iowa. Present rate, 11½c; proposed, 11c.

2898-G. **Sand and gravel**, carloads (See Note 3), but not less than 40,000 lb., from Hawarden, Ia., to Jackson and Lakefield, Minn. Present rates, 11½c per 100 lb.; proposed, $1.50 per net ton.

1601-B. **Limestone**, carloads (See Note 2), except when ore cars are used at railroads' convenience and loaded to full visible capacity, actual weight but not less than 40,000 lb. per car will apply. When cars are not weighed, minimum weight will be marked capacity of car, from Manistique and Blaney Jct., Mich., to Marinette, Wis., and Menominee, Mich. Present rate, 7c; proposed, 6c per 100 lb.

5582. **Sand, molding** (See Note 3), but not less than 40,000 lb., from Greenville, Lutz Spur and Mulberry Grove, Ill., to Beloit, Wis. Present rate, $2.50 per net ton; proposed, $2 per net ton.

1480. **Molding sand**, carloads (See Note 2), but not less than 40,000 lb., from Dallas City, Ill., to Racine, Wis. Present rate, $2.25; proposed, $2.16.

2491B. **Fluxing stone**, carloads (See Note 3), but not less than 60,000 lb., from Valmeyer, Ill., to Peoria, Ill. Present rate, $2.80; proposed, $1.16 per net ton.

CENTRAL FREIGHT ASSOCIATION DOCKET

25010. To establish on **crushed stone**, carloads, North Baltimore, O., to Deshler, O., rate of 50c per ton of 2000 lb. for one-line haul of 12 miles. Present rate, 60c per ton of 2000 lb.

24993. To establish on **stone, crushed**, in bulk, in open top cars, Bloomville, O., to Lexington, O., rate of 80c per net ton. Route—Via P. R. R., Mansfield, O., B. & O. R. R. Present rate, $1.15.

25000. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads, Hugo, O., to the following Ohio points:

To	Prop.	Pres.	To	Prop.	Pres.
Amherst	$0.90	$1.00	Madison	.95	1.00
Danbury	1.05	3.20	Mentor	.85	.90
Geneva	.95	1.00	Unionville	.95	1.00
Kingsville	1.00	1.10			

25001. To establish on **crushed stone**, carloads, Monon, Ind., to stations in Indiana on the P. R. R., rates as shown in Exhibit "B" attached. Present and proposed rates as shown.

EXHIBIT "B"

Crushed Stone, carloads, Monon, Ind., to Stations on the Pennsylvania R. R.—From Monon, Ind., to Indiana points:

To	Pres.	Prop.	To	Pres.	Prop.
Lake Ciecott	97	75	Long Cliff	97	80
Kenneth	97	75	Clymers	97	80
Logansport	97	80	Tecoma	99	85
Anoka	97	80	Camden	99	85
Onward	107	85	Flora	99	85
Bunker Hill	107	85	Walton	107	85
Loree	107	85	Lincoln	107	85
Royal Centre	107	80	Galveston	107	85
Thornhope	107	80	Logan Pit	107	80
Star City	107	85	Adamsboro	107	80
Winamac	107	85	Hoover	107	85
Verona	107	80	Mexico	107	85
Lucerne	107	85	Denver	107	85
Grass Creek	107	85			

25055. To establish on **stone, crushed**, in bulk, in open top cars, and **stone screenings**, in bulk, in open top cars, in straight or mixed carloads (See Note 3), Kenneth, Ind., to Schneider, Ind., rate of $1 per net ton. Route—Via P. R. R., North Judson, Ind., N. Y. C. R. R. Present rate, $1.27 per net ton.

25064. To establish on **crushed stone**, in bulk, carloads (See Note 3), from Mitchell, Ind., to Fairfield, Ill., rate of $1.10, and to Enfield, Ill., rate of $1.20 per net ton. Present rates, 17c to Fairfield and 18½c to Enfield, Ill.

25065. To establish on **crushed stone and crushed stone screenings**, carloads (See Note 3), Huntington, Ind. (rates in cents per net ton):

To	Pres.	Prop.
Churubusco, Ind.	107	90
Columbia City, Ind.	107	85
North Manchester, Ind.	90	75

25067. To establish on **rip rap stone**, carloads (See Note 3), from Mitchell, Ind., to Hazelton, Ind., rate of 95c per net ton. Present rate, 14c.

25094. To establish on **sand and gravel**, carloads (See Note 3), Urbana, O., to East Liberty, O., rate of 70c per net ton. Present, sixth class.

25104. To cancel specific commodity rates on **limestone, crushed or ground** (See Note 3), from Alton, Ill., to points in Indiana, Ohio and Michigan, as named in Item 2822 to and including 2872 of C. F. A. L. Tariff 400K, permitting to apply in lieu thereof, basis of 60% of sixth class, as shown in Item 1670A of C. F. L. Tariff 130T.

25158. To establish on **sand and gravel**, carloads (See Note 3), Fort Jefferson, O., to Rockford, O., rate of 60c per net ton (rate to expire December 31, 1930). Present rate, 70c per net ton.

25162. To establish on **crushed stone**, carloads (See Note 3), Lorain, O., ex-lake (B. & O. R. R.) to Barberton, O., rate of 70c per 2000 lb. Present rate, 80c per 2000 lb.

25163. To establish on **agricultural limestone** (not ground or pulverized), **crushed stone and stone screenings**, in bulk, in open top cars, in straight or mixed carloads (See Note 3), Woodville, Gibsonburg and Maple Grove, O., to Detroit, Mich., rate of $1 per ton. Present rates, $1.02 per net ton from Gibsonburg and Woodville, O., and $1.07 per net ton from Maple Grove, O., via M. C. R. R. as delivering carrier only. Classification basis via other lines where joint hauls are involved.

Industrial Sand Cases in 1930

THE Interstate Commerce Commission has created a proceeding, designated as Industrial Sand Cases, 1930, by consolidating some 40 formal docket cases for hearing and disposition, involving rates on sand used for industrial purposes, such as glass making and molding purposes, with a view to giving them uniform treatment at one time. They have been assigned for initial handling by Examiner Burton Fuller. In a notice issued in connection with the formulation of the new proceeding the commission said that an informal meeting of the interested parties would be held at Washington before Examiner Fuller on June 10. To make way for that informal meeting the hearing which had heretofore been set for May 20, in No. 22907, Illinois Silica Sand Traffic Bureau vs. A. C. & Y. et al.; No. 23111, Pennsylvania Glass Sand Corporation vs. same, and a sub-number thereunder, same vs. same; No. 23245, Industrial Silica Corporation vs. Aliquippa & Southern et al; No. 23266, Ayers Mineral Co. et al. vs. A. C. & Y. et al.; and No. 23340, F. E. Reed Glass Co. vs. Pennsylvania et al, has been cancelled.

Other cases consolidated with those mentioned in the preceding paragraph, upon the record and upon the petition of the defendants in No. 17817, sub-No. 1, Illinois Silica Sand Traffic Bureau vs. Santa et al.; No. 17822, River Raisin Paper Co. vs. Burlington et al.; No. 16250, Indiana State Cham-

ber of Commerce vs. B. & O. et al.; No. 16296, Terre Haute Chamber of Commerce vs. same; No. 17272, Procter and Gamble Co. vs. same, and sub-numbers thereunder, Philip Carey Manufacturing Co. et al. vs. same, Charles Boldt Glass Co. vs. B. & O. and Nivision-Weiskoff Co. et al. vs. same, have been reopened for further hearing and consolidated with the ones which were to have been heard on May 20.

The commission's notice with respect to the meeting to be held June 10 says that the principal object of the meeting is to perfect plans for the preparation and presentation of evidence with a view to avoiding unnecessary duplication and of expediting the proceedings. The matters to be discussed are:

1. Whether the issues may be more clearly defined in accordance with Rule IV (f) of the rules of practice.

a. Contentions with respect to a uniform description of the commodity.

b. Contentions with respect to a uniform basis or bases of rates in the territory embraced in the proceedings.

2. Whether any of the facts may be agreed to in accordance with Rule IX of the rules of practice.

3. Whether, and to what extent, the records in the cases previously heard should be stipulated into the record in the consolidated proceedings.

4. Order of presentation of the evidence.

5. What can be done to avoid unnecessary duplication of evidence.

6. Should exhibits to be offered at each day's session be distributed prior to the beginning of the session?

7. Any other suggestions as to how the above object may be promoted.

The cases, other than those hereinbefore mentioned, that are to be parts of the consolidated proceeding are: No. 23019, Terre Haute Chamber of Commerce et al. vs. B. & O. et al.; No. 23097, Glenshaw Glass Co., Inc., et al. vs. B. & O. et al.; No. 17060, Frohman Chemical Co. vs. B. & O. et al.; No. 15833, Keokuk Shippers' Association vs. B. & O. et al.; No. 18718, American Window Glass Co. vs. B. & O. et al.; No. 19978, Standard Plate Glass Co. vs. B. & O. et al.; No. 18725, Ceramic Traffic Association vs. Pennsylvania et al.; No. 18725, Sub-No. 1, Ceramic Traffic Association vs. Pennsylvania et al.; No. 19743, Swayne, Robinson & Company vs. B. & O. et al.; No. 20230, Portland Company vs. New Haven et al.; No. 21618, Gleason Works vs. New Haven et al.; No. 20554, Swayne, Robinson & Co. vs. Pennsylvania et al.; No. 20733, Abendroth Brothers et al. vs. Boston & Albany et al.; No. 20803, Wheeling Mold and Foundry Co. vs. W. & L E.; No. 20828, Lebanon Steel Foundry vs. Pennsylvania et al.; No. 21133, Chapman Valve Manufacturing Co. vs. B. & O. et al.; No. 21133, Sub-No. 1, Worthington Pump and Machinery Corporation vs. Pennsylvania et al.; No. 21849, Turner & Seymour Manufacturing Co. vs. New Haven et al.; No. 22053, Cadillac Malleable Iron Co. vs. Ann Arbor et al.; No. 21091, Sawbrook Steel Castings Co. vs. C. B. & Q. et al.; No. 21383, Manufacturers Foundry Co. et al. vs. Pennsylvania et al.; No. 21136, Manufacturers Foundry Co. vs. New Haven; No. 21396, Waterbury Ferrel Foundry & Machine Co. vs. B. & M. et al.; No. 21486, Richmond Radiator Co. vs. N. Y. C. et al.; No. 21553, Grabler Manufacturing Co. vs. Erie et al.; No. 22098, National Radiator Corporation vs. B. & O. et al.; No. 22476, H. B. Smith Co. vs. New Haven et al.; No. 22289, Sharpless Separator Co. vs. Pennsylvania et al.; No. 22338, Procter & Gamble Co. vs. B. & O. et al.—*The Traffic World.*

I. C. C. Proposed Reports

22300. Cement. Missouri Portland Cement Co. vs. A. and S. et al, rates on cement from Prospect Hill (St. Louis), Mo., to destinations in Oklahoma and Texas. Complainant alleged that the rates were unduly preferential to competitors in Kansas, Nebraska, Oklahoma and Texas. Examiner Horace W. Johnson found rates unreasonable and unduly prejudicial to destinations in Scale III and IV territories in Texas to the extent they exceeded or might exceed rates based on western cement Scale III to destinations in Scale III territory, and rates based on western cement Scale IV to destinations in Scale IV territory. Examiner Johnson further recommended that the commission should say that in applying the scales mentioned rates should be determined in accordance with the method used for computing distances and checking in rates under the decision in Western Cement Rates, 48 I. C. C. 201 and 52 I. C. C. 225.

22261. Amiesite and Amicrete, roadway materials consisting of stone, crushed, broken or ground, stone screenings and slag, mixed or coated with asphalt, from Smyth, N. C., Atlanta, Ga., High Bridge, Ky., and Birmingham, Ala., to southern destinations. Interstate Amiesite Co. et al vs. Aberdeen and Rockfish et al. Examiner proposes a distance scale and arbitraries for short lines and fourth section application No. 13731 for use instead of commodity rates now in effect on these materials, which rates he states are unreasonable and unduly prejudicial to the extent they exceeded or for the future might exceed approximately 125% of the single and joint line rates prescribed in Rates on Chert, Clay, Sand and Gravel, supra, specifically stated in an appendix in this report but not herein reproduced. Examiner further said that the commission should find that the rates from Smyth, Atlanta, High Bridge and Birmingham to destinations in Florida, south of the Jacksonville-River Junction line, were and for the future would be unreasonable and unduly prejudicial to the extent that they exceeded or might exceed rates determined by the application of the basic distance scales of rates, in the appendix before mentioned, to the entire distance plus arbitraries in cents per net ton for both single and joint-line application determined for that part of the distance lying south of the Seaboard Air Line route from Jacksonville to River Junction, as follows: Thirty miles and under, 30 cents; 60 and over 30, 40 cents; 100 and over 60, 50 cents; 150 and over 100, 60 cents; 200 and over 150, 70 cents; 250 and over 200, 85 cents; 300 and over 250, 90 cents; 350 and over 300, 95 cents, and over 350, 100 cents.

In addition, he said, the commission should find that the short lines might add a maximum arbitrary of 30 cents per ton to accrue solely to the lines represented by J. A. Streyer as agent. The examiner recommended fourth section relief over circuitous routes subject to the equidistant provision and the usual circuity limitations of 70 and 50%. He said that the commission should deny relief to limited destination groups except to the extent authorized to circuitous lines. He also recommended a third class of relief subject to the provision that rates at intermediate points on the short and weak lines should not exceed the scale of rates recommended by him plus an arbitrary of 30 cents per net ton.

Rate Hearing in Virginia on Mica and Slate

PUBLIC hearings on rates on mica and slate are being held in Richmond, Va., before Examiner Wilbur of the I. C. C.

The Virginia Shippers' Association is the complainant, and it is represented by H. E. Manghum. The association asks that rates for shipments between Richmond and various Southern points be harmonized, that rates be reduced, and that in the event of a reduction, transportation companies should make reparation on previous shipments.

Sand Company Files Complaint Against Switching Charge

THE Victory Sand Co. recently filed a complaint with the Kansas Public Service Commission against the Union Pacific Railroad Co., claiming the railroad makes a discriminatory switching charge on carloads of sand originating at the company's plant in Topeka, Kan.

Charles F. Real, traffic commissioner for the Topeka Chamber of Commerce, filed the complaint on behalf of the sand company. It is charged the road refuses to accept shipments from the Victory plant, which is located on the Santa Fe railroad, without the $2.25 switching charge. Competition is keen between the Victory, Consumers, Kansas and River sand companies, all operating in Topeka. The three companies mentioned are located on the Union Pacific lines, without a charge, states Real, who charges this also is a discrimination.—*Topeka* (Kan.) *Capital.*

Pennsylvania-Dixie Cement Corp. plant No. 6 at Bath, Pe

Dixie Cement Corp. plant No. 6 at Bath, Penn.; annual capacity 2,100,000 bbl.

Lime Industry Plans Progressive Future

Chicago Convention, June 3 and 4, Adopts Program for Collection of Statistics and for Advertising

THE NATIONAL LIME ASSOCIATION, through the able management of Norman G. Hough, president and general manager, is finally taking the fundamental, initial steps to rehabilitate the lime industry. An interested and enthusiastic group of 72 manufacturers, representing approximately one-half the total production of the industry, meeting in Chicago, June 3 and 4, endorsed a program for the collection of monthly statistics of production and shipments, and for the expenditure of $45,000 for a national advertising campaign.

Through the courtesy of the Westinghouse Electric and Manufacturing Co., the "Westinghouse Salute," a well-known and popular radio N.B.C. feature, on June 3, was devoted to the lime industry. The principal address on lime was made by President Hough and is reproduced elsewhere in this issue in full. If absent lime manufacturers, among the fourteen or fifteen million listeners to the broadcast from 33 stations in hook-up, were not enthused as were those who listened about the National Lime Association's banquet tables, they certainly are hopeless as assets of the industry.

Bernard L. McNulty Presides

The convention was opened Tuesday morning with Bernard L. McNulty, chairman of the board of directors, presiding. Mr. McNulty introduced to the meeting Fred W. Sargent, president of the Chicago and Northwestern Railway Co., who welcomed the convention to the city and brought out in the course of his talk the importance of lime in agriculture and industry and the great potential possibilities of the lime industry as one of the basic industries of the country.

Following the report of Ralph P. Wilton, treasurer of the association, and the appointment of committees on resolutions and auditing, Norman G. Hough, president and general manager of the association, addressed the convention on "What's Ahead for the Lime Industry." First, describing briefly the activities of the association during the past year, Mr. Hough went on to show the importance and need of greater co-operation and more united group action as a way of solving some of the problems of the industry, also pointing out the benefits to be gained by modern merchandising methods directed toward the development of larger markets. He also brought out the importance of having available more statistical information on the industry, and proposed that monthly reports on production and distribution be made to the association. This information is to be consolidated and sent out to those reporting. He explained that this was now being done in three of the National Lime Association districts in greater detail and he urged its general adoption.

The proposed monthly statistics cover the production and shipments by states of lime and hydrate subdivided into their principal uses: agricultural, construction, chemical, finishing. The statistics of shipment are those into the various states and for various purposes. The reports will also show the number of producers reporting, their rated plant capacities, and the percentage of plant capacity utilized. In other words, they are similar to the monthly statistics of the portland cement industry now compiled by the U. S. Bureau of Mines, which have proved invaluable to that industry.

Bernard L. McNulty, chairman of the board of directors

President Hough also touched on the need for greater efficiency and lower costs, in common with the trend in all lines of basic industry today. More profit does not necessarily mean higher prices; but the elimination of waste and possible lower costs. He also discussed the experience of the industry with its code of trade practices, adopted at the 1929 annual convention and approved by the Federal Trade Commission last November. President Hough reminded the convention of the machinery set up by the association to encourage observance of the code; he said there had been but one reported violation of a Group I rule in the time elapsed since the adoption of the code, and this had been quickly settled, satisfactorily, without calling upon the Federal Trade Commission, or even notifying it of the violation. President Hough did not anticipate that the Federal Trade Commission would be called upon to enforce the code for the lime industry or for other industries with similar codes except in rare instances.

George B. Wood Presides

The afternoon session of Tuesday was opened with Geo. B. Wood, past-president of the association, presiding in the absence of Charles Warner, past-president, who was unavoidably detained.

Addresses were made by W. V. Brumbaugh, assistant secretary of the association; H. A. Huschke, director of agricultural department of the association, and C. E. Ellsworth, construction engineer of the association, on the subjects respectively of chemical lime, agricultural lime and construction lime.

Mr. Brumbaugh called attention to the advertising campaign which the association has been carrying on in some of the trade papers and to numerous other activities. He also brought out the possibilities of a larger use of lime in the oil refining industry and in oil flotation and metallurgical work, and particularly in water softening. His paper was so good and the information of such practical value that it will be published in full and distributed to members of the association exclusively.

The figures which Mr. Brumbaugh gave showed that more than 85,000 tons of lime were being used in oil flotation work, and more than 150,000 tons in water softening. There are now more than 110 water softening plants, of which 98 are using lime. Experiments now under way indicate the enlarged use of lime in open-hearth furnace work.

Mr. Huschke showed a number of charts giving the results of soil liming in a number of states, and brought out the facts that liming showed a net profit of $2 for every dollar invested in the case of grain crops; and in the case of truck-garden vegetables, a net profit of $33 for every dollar invested. The present tendency to use concentrated fertilizers should prove to the advantage of lime manufacturers, he thought, in their competition with limestone.

Mr. Huschke presented a definite program for the promotion of agricultural lime, which was outlined as follows: (*A*) Promotion and publicity through (1) news releases; (2) special articles for the farm papers; (3) monthly letters to county agricultural agents:

(*B*) Education through (1) pamphlets and bulletins; (2) supplementary bulletins; (3) co-operation with high schools having agricultural departments, agricultural colleges, farm press, etc.: (*C*) Research through personal contact with those already engaged in agricultural research.

Mr. Ellsworth's talk emphasized a point generally overlooked, the non-leaking and non-efflorescent properties of walls laid up with lime mortar. Mr. Ellsworth stated that reference to engineering literature prior to about 1900, during the time when lime mortar was used entirely, disclosed nothing on the matter of leaky walls and efflorescence which later, with more general use of mortars rich in portland cement and lean in lime, have caused considerable trouble. Mr. Ellsworth had found from personal experience that cement mortar could not be used in high chimney work because of the stresses set up and the consequent breaking loose of the brick joints, but he did find that a mortar of approximately 2 parts lime, 1 part cement and 5 parts sand was best. According to Mr. Ellsworth, the mortar used in walls or other brickwork should consist of at least one-half and preferably two-thirds lime. As to efflorescence, this seems to be due principally to calcium sulphate, $CaSO_4$. According to Mr. Ellsworth, the construction industry has made a serious mistake to go as far as it has in the use of cement mortar with as low as 10% of lime. Such mortar, because of expansion and contraction, breaks loose from the brick or stone, allowing water to enter, which dissolving the calcium sulphate salts in the cement produces the discoloration known as efflorescence.

Mr. Ellsworth also brought out the need of concentrating more on the architect, engineer and building official, as well as the regular lines of trade.

Proposed Advertising Campaign

The concluding session was held Wednesday morning, Bernard L. McNulty presiding.

In the absence of Charles Warner, President Hough presented the report of the lime industry's representative on the National Business Survey Conference. During the first four months of this year the apparent trend of the lime industry has been about 13% off from the same period in 1929. All of the loss has been in construction.

Following this, W. J. Chandler, director of merchandising, Thomsen-Ellis Co., Baltimore, Md., presented an outline of the advertising campaign which the association has tried during the past four months and which it proposes to continue on a larger scale during the ensuing 12 months. He showed in detail the proposed schedule for trade paper advertising and the way in which it will be divided up between the three principal fields of chemical, construction and agricultural lime, and also explained the additional booklets proposed, urging the support of all in the industry for this association promotional work as being the most effective way of increasing the markets and uses of lime.

A budget of approximately $110,000, including $45,000 for advertising, was unanimously adopted. This means dues on the basis of 3½ c. per ton, the present rate.

Officers and Directors

Norman G. Hough was re-elected president and manager; Ralph P. Wilton, secretary and treasurer, and W. V. Brumbaugh, assistant secretary. Bernard L. McNulty was re-elected chairman of the board of directors. The directors chosen as an executive committee were J. M. Deeley, Reed C. Bye, J. M. Gager and H. B. Mathews, who will choose the fifth member.

The following directors of the association

George B. Wood, past president, occupied the chair for the Tuesday afternoon session

were elected by the various districts or regional groups: District 1: J. R. Linney, Chazy Marble Lime Co., Chazy, N. Y.; C. L. Montgomery, Vermarco Lime Co., West Rutland, Vt.; District 2: Reed C. Bye, Warner Co., Philadelphia, Penn.; S. Walter Stauffer, J. E. Baker Co., York, Penn.; District 3: Ray C. Noll, Whiterock Quarries, Inc., Bellefonte, Penn.; District 4: Election to be held; District 5: G. J. Whelan, Kelley Island Lime and Transport Co., Cleveland, Ohio; District 6: G. J. Nicholson, Inland Lime and Stone Co., Manistique, Mich.; District 7: B. L. McNulty (chairman of the board), Marblehead Lime Co., Chicago, Ill.; E. S. Healey, Glencoe Lime and Cement Co., St. Louis, Mo.; District 8: R. C. Brown, Western Lime and Cement Co., Oshkosh, Wis.; James Fryer, secretary, Wisconsin Lime Manufacturers Association, Chicago, Ill.; District 9: Election to be held; Districts 10 and 11: F. C. Cheney, Cheney Lime and Cement Co., Birmingham, Ala.; District 12: J. F. Pollock, Ash Grove Lime and Portland Cement Co., Kansas City, Mo.; District 13: I. A. Ogden, Dittlinger Lime Co., New Braunfels, Tex.; District 14: J. S. McMillan, Roche Harbor Lime and Cement Co., Roche Harbor, Wash.; District 15: C. M. Cadman, United States Lime Products Co., San Francisco, Calif.

Banquet

Col. George T. Buckingham, prominent corporation attorney of Chicago, made the principal address at the annual banquet. The subject was federal anti-trust laws, with which he has had much experience. In a nutshell he believed them out-of-date; but he did not hold out much encouragement that they would soon be changed.

Registration—Producers

American Lime and Stone Co., Bellefonte, Penn.
G. I. Purnell.
Amsden Lime Co., Amsden, Vt.
Joseph La Belle.
Ash Grove Lime and Portland Cement Co., Kansas City, Mo.
W. R. Anderson, Kansas City, Mo.
Paul Sunderland, Springfield, Mo.
Austin White Lime Co., Austin, Tex.
J. H. Chiles.
J. E. Baker Co., York, Penn.
S. Walter Stauffer.
Batesville White Lime Co., Batesville, Ark.
Geo. T. Weigart.
Cheney Lime and Cement Co., Birmingham, Ala.
F. C. Cheney.
G. and W. H. Corson, Inc., Plymouth Meeting, Penn.
Bolton L. Corson.
Dittinger Lime Co., New Braunfels, Tex.
I. A. Ogden.
Gager Lime Manufacturing Co., Chattanooga, Tenn.
J. M. Gager.
Glencoe Lime and Cement Co., St. Louis, Mo.
E. S. Healey.
Green River Lime Co., Greensburg, Ky.
M. R. Atteberry.
J. F. Groth and Son, Cedarburg, Wis.
E. J. Groth.
Haden Lime Co., Houston, Tex.
Cecil R. Haden.
Hoosier Lime Co., Salem, Ind.
H. L. Vernia.
Hunkins-Willis Lime and Cement Co., Lauderman Bldg., St. Louis, Mo.
W. F. Fitzroy.
D. S. Hunkins.
Gordon Willis.
Indiana Limestone Co., Bedford, Ind.
John G. Drummond.
Inland Lime and Stone Co., Manistique, Mich.
Gordon W. Hughes.
G. J. Nicholson.
John W. Jenkins and Son, Springfield, Ohio.
D. H. Jenkins.
Kelley Island Lime and Transport Co., Cleveland, Ohio.
A. B. Mack.
Geo. J. Whelan.
Lee Lime Corporation, Lee, Mass.
J. M. Deely.
Limestone Products Co., Menominee, Mich.
N. S. Meyers.
Marble Cliff Quarries Co., Columbus, Ohio.
T. L. Pankey.
E. C. Powers.
Russell Rarey.
Marblehead Lime Co., Chicago, Ill.
F. H. Belden.
J. S. Elwell.
M. R. Mathews.
Bernard L. McNulty.
R. S. Peotter.
William J. Stewart.
Mayville White Lime Works, Mayville, Wis.
Carl G. Ruedebusch.
Carl H. Ruedebusch.
K. C. Ruedebusch.
Mississippi Lime and Materials Co., Alton, Ill.
Joseph C. Aldous.
Harry B. Mathews.
The Moores Lime Co., Springfield, Ohio.
Wm. H. Moores.
Nast Lime and Stone Co., Eden, Wis.
Edw. A. Nast.

New England Lime Co., Pittsfield, Mass.
Bernard L. McNulty.
R. S. Peotter.
North American Cement Corp., Albany, N. Y.
Fred A. Boeye, New York, N. Y.
John F. Gruber, Hagerstown, Md.
L. F. Owen and Co., Chicago, Ill.
Robert Cummings.
Peerless White Lime Co., St. Louis, Mo.
Gordon Willis.
Rockland and Rockport Lime Corp., Rockland, Me.
Donal O'Connor, 50 E. 42nd St., New York, N. Y.
George B. Wood, Rockland, Me.
Standard Lime and Stone Co., Fond du Lac, Wis.
W. A. Titus.
Sheboygan Lime Works, Sheboygan, Wis.
E. C. Carter.
Miss E. H. Roth.
Ste. Genevieve Lime Co., St. Louis, Mo.
C. H. Kammann.
Karl P. Kammann.
Steacy and Wilton Co., Wrightsville, Penn.
R. P. Wilton.
United States Lime Products Corp., 58 Sutter St., San Francisco, Calif.
Chas. M. Cadman.
Universal Gypsum and Lime Co., Chicago, Ill.
Eugene Holland.
Frank G. Krumholz.
Valders Lime and Stone Co., Valders, Wis.
B. Brennan.
Vermarco Lime Co., West Rutland, Vt.
Charles L. Montgomery.
Warner Co., 1518 Walnut St., Philadelphia, Penn.
Charles C. Bye, Philadelphia, Penn.
Reed C. Bye, Wilmington, Del.
W. R. Hazzard, Philadelphia, Penn.
West Branch Lime Co., Williamsport, Penn.
John B. Fox.
The Western Lime and Cement Co., Milwaukee, Wis.
R. C. Brown, Oshkosh, Wis.
E. E. Long, Fond du Lac, Wis.
V. F. Nast, Milwaukee, Wis.
B. B. Williams, Milwaukee, Wis.
Whiterock Quarries, Bellefonte, Penn.
Ray C. Noll.
York Valley Lime and Stone Co., York, Penn.
F. W. Cramer.

Others

Advertising Age, 537 South Dearborn St., Chicago, Ill.
M. E. Crain.
Blaw-Knox Co., Pittsburgh, Penn.
Wm. J. Kuntz.
H. E. Brookby, 1340, 53 West Jackson Blvd., Chicago, Ill., consulting engineer.
C. & N. W. Ry. Co., 400 West Madison St., Chicago, Ill.
Fred W. Sargent.
Defrees, Buckingham, Jones and Hoffman, Chicago, Ill.
Col. George T. Buckingham.
Stephen E. Hurley.
Engineering News-Record, 520 North Michigan Ave., Chicago, Ill.
E. E. R. Tratman.
National Lime Association, Washington, D. C.
W. V. Brumbaugh.
C. E. Ellsworth.
Norman G. Hough.
H. A. Huschke.
Pit and Quarry, Chicago, Ill.
A. J. Hoskin.
ROCK PRODUCTS, Chicago, Ill.
E. C. Harsh.
Nathan C. Rockwood.
Thomson Ellis Co., Baltimore, Md.
W. J. Chandler.
Valve Bag Co., Toledo, Ohio.
C. H. Corbett, New York, N. Y.
Burton A. Ford, New York, N. Y.
A. G. Hartman, Toledo, Ohio.
Walter M. Neill, New York, N. Y.
Wheeling Mold and Foundry Co., Wheeling, W. Va.
Wm. H. Sallwasser.
Wisconsin Lime Manufacturers' Association, Chicago, Ill.
James Fryer, secretary.

President Hough's Radio Broadcast

LIME manufacturers of the United States are receiving this tribute to the lime industry as they are assembled about the banquet tables in the Edgewater Beach hotel, Chicago, on the occasion of the twelfth annual convention of the National Lime Association, and on behalf of those manufacturers who serve all people, directly or indirectly, I extend greetings.

The lime industry is one of the oldest industries in the world, and without question, one of the most useful. The uses for its products are varied and extensive almost beyond belief. Perhaps no other industry is of greater importance to the people of the United States in the production of the three great necessities of life—food, shelter, and clothing. Many manufactured products require lime somewhere in the fabricating process, and without it plant and animal life would probably cease entirely.

Many of the present-day uses of lime were discovered, developed or improved through scientific investigation. Lime in concrete is now sound, economic practice, the result of investigations and experiments which were started as early as thirty years ago. One of the greatest complaints in the building industry today is that masonry walls of our modern buildings are not made watertight. This develops needless and expensive repairs. Here again, lime is providing its efficiency as a masonry mortar and contributing greatly to the elimination of waste. Likewise lime plaster is filling the needs of architects who seek satisfactory acoustical conditions in buildings where such conditions are necessary.

In many of our American cities the water supply contains a considerable percentage of mineral salts. It is commonly known as "hard water." Nearly everyone is familiar with the hard water problem. Its effect is apparent by discoloration of enameled fixtures in bathrooms, by lack of whiteness in laundered garments, and by plumbing bills necessitated by scale formation in water pipes. Lime is a material depended upon to remove the mineral elements which bring about these undesirable and costly effects. Over one hundred cities have already installed water-softening plants, but it is not generally known that millions of dollars are still needlessly wasted annually by the American home owner and by the housewife in overcoming the effects of hard water. The time is not far distant when every community having a population of 10,000 or over, located in hard water districts, will operate its own water-softening plant to eliminate this waste. This is another instance illustrating the social and economic importance of lime. I could go on indefinitely citing additional uses equally important but will mention just one other.

President Hough, who delivered the address in connection with the Lime Industry Salute radio broadcast

We hear considerable about farm relief and the agricultural problem. It is a fact, though, that in almost every rural community a small percentage of farmers have prospered and are now prospering in their chosen vocation. Study these men carefully and you will find them keen students of their business. They do not employ "hit or miss" methods—they follow the same fundamental principle which guides all successful manufacturers—they lower their cost of production. Almost without exception, soil liming is an indispensable part of their program. But one does not have to be a farmer to profit by the beneficial effects of lime on the soil; in all probability that much admired lawn or garden, right in your own neighborhood, has received its application of lime whenever needed.

Because the accomplishments so far attained in this industry are so vitally important to all, I take this opportunity to acquaint you with the efforts which are being made by the progressive lime manufacturers to serve you better.

The National Lime Association is organized for the purpose of encouraging a better appreciation of the value of lime in all its uses. As stated before, lime is used in the production of practically all of our everyday commodities, consequently new problems pertaining to its true place in industry, construction and agriculture are constantly arising. For this reason the association maintains a staff of highly trained technical men; construction engineers, chemical engineers and agricultural experts, capable of coping with these many and diversified problems. It is only by establishing fundamental facts about lime that we can increase the value of the industry to you.

This organization is ceaselessly at work making researches, conducting laboratory and field investigations, co-operating with numerous recognized scientific and engineering societies, with the United States Bureau of Standards, and with the United States Department of Agriculture, to the end that lime may be improved, and that the best methods of using it may be made known to everyone.

Great Lakes Crushed Stone, Sand and Gravel Distributor Expands

THE LAKE PORTS SUPPLY CO., Detroit, Mich., has just taken over the entire operation of the ultra-modern Atwater yard, located at the foot of Rivard street, and also the huge Fairview yard, situated at the foot of Lycaste, according to a statement issued May 24 from the company offices at 1917 Penobscot building by E. L. Jones, district manager.

The Atwater yard, which was owned formerly by the United Fuel and Supply Co., occupies more than six acres of choice ground along the Detroit river front and is said to be the most completely equipped yard for the handling of sand, gravel and stone in the country.

All material is hauled from the boats to its up-to-date bins, which have a combined storage capacity of more than 3500 tons, by electrically operated belt conveyors of the latest type. Its driveways are of solid concrete and the excellent docking facilities accommodate the largest self-unloading boats and bulk freighters on the lakes.

The much larger Fairview yard, conveniently located on the east side of Detroit with unusually accessible approaches, covers an area of 22 acres and includes, among other facilities, a slip running along 1400 ft. of frontage, which is of sufficient length to permit the unloading of three boats at one time. And when the installation of new and modern equipment, even superior to the present outstanding Atwater yard, has been completed, it is said that the "Big Fairview" will be the peer of any dock in its class in the world.

The addition of the Fairview yard at the eastern end of town and the Atwater in the central section gives the Lake Ports company docking facilities along the entire Detroit river frontage, as their present yard, located at River Rouge, amply covers the requirements of the western end of the city.

This puts the Lake Ports company in the enviable position of being able to serve their customers with any quantity and grade of concrete aggregates at any time during the winter months, since they will have complete storage facilities for more than 500,000 tons of material. A quality of service that, undoubtedly, will be welcomed by the local dealers.

"It has been the constant aim and policy of the Lake Ports company to spare neither pains nor expense to further the interests, not only of its individual dealers, but of the industry as a whole," said Mr. Jones in speaking of the company's recent acquisitions, "and it is with that progressive and co-operative thought in mind that our corps of engineers, second to none in the country in their line, are continually planning for the future.

"In this constructive manner it is hoped that the industry will be placed on a more solid footing and will be able to render continually improved service to the public."

The Lake Ports company, which represents a consolidation of the local Dolomite Materials Co., the Ohio Coal and Supply Co., Cleveland, and several other distributing companies, was organized for the purpose of handling and distributing, to better advantage, the crushed stone and sand produced along the entire Great Lakes region.

The combine makes the company the largest retail distributor of commercial crushed stone and concrete aggregates in this section of the country, and its many ramifications permit of a steady disposal throughout the year of more than 4,000,000 tons of material.—*Detroit* (Mich.) *Evening Times.*

Gypsum Cave Reveals Valuable Anthropological Data

CAMPFIRE ashes indicating that man lived on the North American continent twenty or thirty thousand years ago, instead of the mere 3500 years accepted, have been discovered in the gypsum cave in southern Nevada, the Southwest Museum announced in a despatch through the United Press. The discovery, which may rewrite early chapters of the anthropological history of the continent, was told in a telegram from M. R. Harrington, head of the expedition, to Dr. J. E. R. Scherer, of the museum.

The date of the campfire was set as more than 20,000 years ago because the charcoal ring that means a blaze kindled by human hands was found in the layer that contains remains of ground sloths, animals which scientists hold were of the Pleistocene period. Geologists say that the Pleistocene age was from 20,000 to 30,000 years ago.

According to Dr. Scherer this is the first time human traces have been found in North American contemporary with the remains of Pleistocene animals. Either man lived 20,000 years ago on the continent or Pleistocene animals persisted for 20,000 years longer than believed, he said.

Recently the party found remains of the Pueblo and Basket Maker peoples, residents of 3,000 years ago, on the surface. Then they dug to a layer of mountain sheep refuse, then a stratum of broken rock left by an ancient landslide, more traces of mountain sheep and finally the layers of dust and gravel in which the skeleton, claws and other fragments of the ground sloth were found. In the same layer was the mark of the campfire.

Canadian Asbestos Exports

ASBESTOS exports during April totaled in value $467,523, against $594,694 in March and $616,616 in April, 1929. Total for asbestos, plus asbestos and waste sand, plus asbestos manufactures, was $637,994, against $804,663 in March and $760,838 in April, 1929.

Monterrey Cement Plant, Mexico, Doubles Capacity

CAPACITY of the "Monterrey" cement plant, in accord with a decision made by the board of directors, will be doubled, increasing the daily output from 1000 to 2000 bbl. This increase in the plant will necessitate construction of a second unit of equal size with the existing mill, necessitating a raw grinding mill, cement grinding mill, kiln, stock storage silos and bins, another system of belt conveyors and all accessories necessary to complete the factory.

Ground for the new mill was broken the latter part of April, and work on the conveyor pits and machinery foundations was started at the same time. All the new machinery has been ordered from the Traylor Engineering and Manufacturing Co., Allentown, Penn., and delivery of the first units is expected within a month. Completion of the entire plant will require only a few months and the plant will be working at its new capacity on or about the first of September.

Order for the big, super-synchronous motors was placed with the General Electric Co., whose representatives here telegraphed for the machines required.

Construction of the new plant and installation of the machinery is to be let out to various contractors, each of whom is a specialist in his line. Total cost of these contracts, and the plant material probably will amount to about 750,000 pesos.

Capitalization of the cement company has been increased from $1,230,000 to $2,200,000, all of which has been paid in. Ownership of the company is local. At the last board meeting the company directors voted to permit the public to participate in ownership and a certain amount of shares will be placed on sale, subscriptions being opened May 10 and closed May 24. Value of the shares is 100 pesos each, par.

Zambrano Re-elected President

Officers elected, many of them re-elected, at the general meeting held April 11, are: President, Lorenzo Zambrano; vice-president, Prisciliano Elizondo; treasurer, Adolfo Zambrano; secretary, Jose Zambrano Gutierrez; directors, Pablo Salas y Lopez, the general manager; Rodolfo M. Garcia, manager for the Banco de Nuevo Leon; Victor de Lachica, manager for the Fyusa; Lic. Elias Villarreal and Thomas Williams, of the Cia. Constructora y Colonizadora.

The correct name of the cement company is Cementos Portland, "Monterrey," S. A. The plant is situated near the American Smelting and Refining Co.

The engineer who will be in charge of drawing plans and construction of the new unit is H. E. Leach, superintendent of the plant.

Limestone Caverns Opened to Public by Concrete-Lined Mine Shaft

By Dan M. McNeil
Albany, N. Y.

SOME 3400 tons of concrete were used in sinking the 156-ft. elevator shaft at Howe Caverns, N. Y., a natural wonderland which was recently opened to the public; and for various purposes within the caverns, including a concrete-lined tunnel leading from the shaft to a rotunda where the tour of the caverns begins. The walls, arches and piers of the rotunda are of concrete; the 700 lamps in an indirect lighting effect are set in concrete; and there are concrete stairways at several points so that the tourist, if he chooses, may leave the elevator before its full descent is made, and wander at will among the interesting formations.

The caverns were discovered by Lester Howe, a farmer, in 1842. They are within an hour by rail from Albany, Troy and Schenectady, in the heart of the picturesque and historic Schoharie Valley, and their convenience of access made them one of the most popular attractions for sight-seers in the United States. Some time after the death of Howe, who had made a fortune in admission fees, they were closed, and had not been visited in nearly fifty years until a few months ago when there was a change in ownership.

Editor's Note

WE ARE stretching a point to publish this in ROCK PRODUCTS. But these limestone caverns are rock products. To be sure, they are not sold as such, but are being commercialized, nevertheless.

So, any limestone quarry operator fortunate enough to discover similar caverns under his quarry or through his mining operations may have an asset more profitable than crushed stone. For there is a tremendous popular interest in underground caverns—dating back perhaps to the cave life of our ancestors.—Editor.

The sinking of the shaft was an outstanding achievement. The work was begun June 6, 1928, and the actual sinking was completed August 30. Approximately 105 ft. was drilled and blasted through clay and boulders and the remainder through solid rock.

The clay and boulders were loaded into scale boxes by a Nordberg-Butler air shovel and were hoisted to the surface by a guy derrick. At a depth of 35 ft. the use of the shovel was abandoned on account of the heavy side pressure on the timber, which necessitated bracing so close that it hampered shovel operations. The weather further retarded the work as it rained practically every day, causing the clay to become so sticky that it was handled with difficulty.

The usual method of sinking a concrete caisson as far as the solid rock was thought inadvisable, there being the possibility that it might get slightly out of plumb, and it was decided instead to timber the shaft to the rock and complete the sinking before any concrete was placed in the shaft. The wisdom of this course was apparent when the bore hole which was within 10 ft. of the site of the proposed shaft showed 65 ft.

Unusual photographs taken in new limestone caverns opened near Albany, N. Y. A view at the left of the Cascade of Gold, and, right, one of the symmetrical arched roofs

of clay and boulders overlying the solid rock, but in sinking the shaft it was found that the bore hole had struck the rock just on the edge of an underground ledge, while in the shaft the rock was 40 ft. deeper.

The shaft was cribbed to a depth of 90 ft. below the surface, and heavy railroad iron was placed in the two cross walls at intervals of about 10 ft. in height to help brace the cribbing and were left in place when the concrete was poured. The wooden cribbing around the outside of the shaft was also left in place and the concrete poured against it.

From the top of the rock down to the bottom of the shaft, a distance of approximately 60 ft., no cribbing was necessary. but in blasting out the rock a much larger portion of rock came loose than was required and the extra space was filled in solid with concrete, thus making the walls in some places from 3 to 4 ft. thick.

Special attention was paid to the tamping of the concrete and the amount of water used in the mix. The aggregate used throughout was crushed limestone, ¾ to 1½ in., using about a 1-2-4 mix. During the severe weather the ingredients were heated just enough to keep them from freezing while on the surface. After the concrete was poured and placed there was no danger from freezing, as the temperature in the shaft ranged from 40 to 45 deg. F.

Construction joints were made every 4 ft. 4 in. in height, and the inside forms were built in sections to this height and were raised up and re-used as the concrete work was carried up.

The concrete was run direct from the mixer by chute into a vertical chute which dropped into a hopper and from there it was carried into the forms by means of steel chutes.

A stucco and timber lodge has been designed after an old English manor house at the surface above the caverns.

The limestone formation at Howe caverns is eight miles thick. The caverns proper have been opened for three miles. It is thought that the unknown area may be very large. There are four avenues now blocked by earth and rocks which eventually will be excavated.

The age of the caverns, according to geologists, dates back many millions of years when the seas were not confined to their present bounds and the tides of the Atlantic, now 150 miles distant, began to hollow out passageways in the soft limestones. A stalactite may grow but an inch in a hundred years. One in Howe caverns is 28 ft. in diameter. The roof is studded with tiny, pencil-like stalactites, each with a fresh deposit of lime at the tip, showing that the caverns are still in process of growth.

Possibly the chief curiosity of the caverns is a winding way which extends 550 ft. It has been formed entirely by erosion and twists and turns so that a person 3 ft. ahead of another cannot be seen by the one behind. A beautiful little stream flows through the caverns, producing waterfalls with musical notes, and in one instance shimmers down over flowstone, appropriately named the Cascade of Gold. Among a great variety of formations is the cavern Witch, showing a hideous profile in stone. A Cathedral Archway is almost perfect, architecturally.

How Caves Have Been Developed by Use of Explosives*

By R. W. STONE
Pennsylvania Geological Survey

RECENTLY, the superintendent of a limestone quarry told me that he set off a blast and the quarry face hardly bulged. It blew in, instead of out, disclosing a cavern. He was interested in producing crushed stone and not in catering to the curiosity of tourists, so that underground cavern was lost. However, a farmer in Berks county, Penn., blasting out limestone for his own use back in 1871, by chance uncovered a cavern, closed the entrance with a stout door, and ever since 1873 Crystal Cave has been a moneymaker.

Ten Caves in Pennsylvania

Of course, very few blasts uncover a hidden cavern, but, nevertheless, many such underground phenomena have been disclosed by explosives. Not only do explosives aid in locating these passages of stalagmites and stalactites, but they also make the caves available to the public.

The exploitation of limestone caverns is becoming an important business; in Pennsylvania alone, ten of them are open to the public.

Nowadays a cavern not only must be worth seeing, but it also must be equipped properly to attract visitors. Where venturesome boys and girls crawl or wriggle through narrow passages, climb over slippery rocks, or slide down clay banks, adults demand paths wide enough to permit passing without rubbing the side walls, solid stairs with handrails, and good illumination.

Explosives Clear Passages

Some Pennsylvania caves, like Woodward Cave in Centre county, have ample clearance and no obstruction to passage on an easy grade. Others, like Indian Echo Cave near Hummelstown, in their natural state are difficult to traverse. At Indian Echo, a large limestone block which fell from the ceiling closed the natural stream grade passage and forced tourists to climb over it. Explosives removed this block and provided a clear course which made the depths of the cave accessible.

At Alexander Caverns, Penn., the only natural entrance was by boat on an underground creek. About 400 yds. from daylight was a dry cavern which contained a wonderful development of stalactites and stalagmites. Since transporting visitors by boat proved too slow a process, especially on Sundays and holidays when large numbers were expected, it was decided to sink a slope to the dry cave. This was accomplished successfully with explosives, and now a continuous line of visitors can be accommodated by the flight of 115 concrete steps leading from the surface to the cavern 65 ft. below ground.

It has been advisable in some caves, such as Historic Indian at Franklinville, Penn., to break off a corner of limestone that projected into a narrow passage, to remove rough places in the floor, or to take down a bit of ceiling to make head room. Where delicate, fragile cave formations are all around, and perhaps there is not room to swing a sledge, light charges of a slow-acting explosive have been used successfully without breaking the stalactites.

75-Ft. Rock Wall Pierced

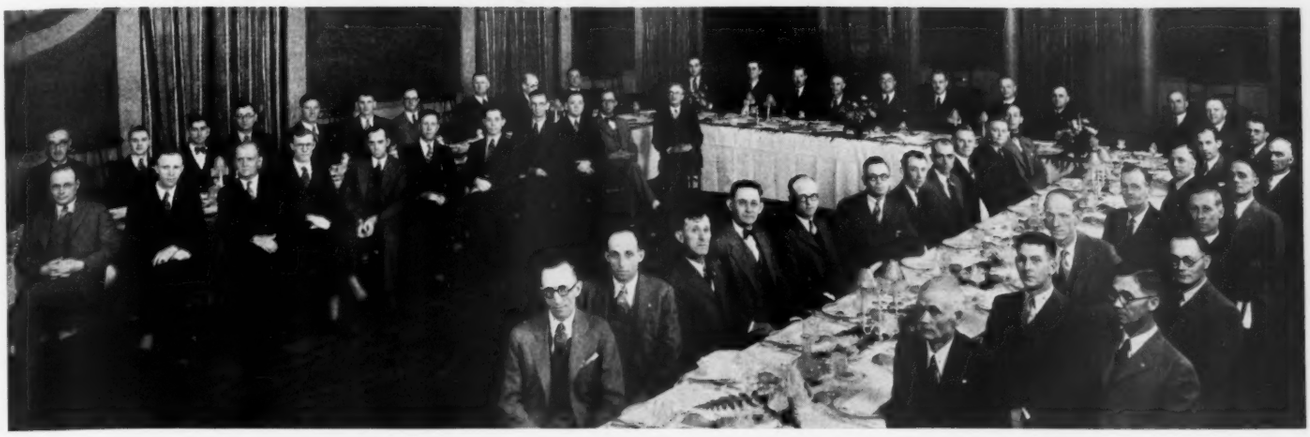
Another use of explosives in the development of a Pennsylvania cave was made last year at Penn Cave in Centre county. Known as a "wet" cave, since 1885 it has been accessible only by boat. About 1,200 ft. from the entrance, the stream disappeared and the cave ended in a solid rock wall. A tunnel was blasted through 75 ft. of this rock to daylight, and the boats, after passing through the cave, now go out on to a mill pond before retracing the route. This gives the visitors a boat ride almost ¾ mile ling. Cave formations, which are not seen going into the cave, are revealed on the return trip by the searchlight on the boat. The short tunnel where the water had not worn a passage adds a quarter of a mile to the trip and a respite in daylight from the darkness and mystery of the cavern.

These are only a few of the varied uses of explosives in the preparation of caverns for entertainment of visitors.

*Reprinted from the June, 1930, issue of *The Explosives Engineer.*

Oregon Gravel Producer Gets Long-Term Contract

A CONTRACT for one year and renewable for a period of three years at the option of the county, was entered into recently between the Coos county court and the McGeorge Gravel Co. of Marshfield, Ore. The company agreed to furnish gravel for county highways at a price of $1.25 per yd. for class A and $1.05 for class B, plus an unloading charge of 15 cents per yard.—*Marshfield* (Ore.) *News.*



Banquet tendered delegates to Portland Cement Association meeting in New York

Cement Association Receives and Awards Safety Honors

THE AWARDING of safety trophies to member mills of the Portland Cement Association constituted one of the highlights of the spring meeting of the association held in the Biltmore, New York City, on May 26, 27 and 28.

While the formal ceremonies pertaining to the award took place on Wednesday, May 28, they were preceded by a number of sessions of vital interest to the safety work of the industry. On May 26, the directors of the association met and decided that although it had been proposed to discontinue bringing delegates from accident-free mills to association spring meetings at association expense, this feature would be continued as a part of the award.

This news will be heralded with enthusiasm by all of the mills because it means that in the future as in the past, two men from each mill completing a year without lost time, permanent disability or fatal accident, will be sent to the association meeting with a week of educational and entertainment features at the expense of the Portland Cement Association. These trips are costing the association about $10,000 per year.

At its meeting on May 26, the Committee on Accident and Insurance of the association formally canvassed the records of the 138 mills competing for its 1929 safety trophies and the record of twenty-eight plants was found clear. Twenty-six of these operated more than the six months minimum requirement and were certified to receive the award. One additional plant record was found to contain a small disability which is believed not to be permanent and the award of the trophy was withheld for a few months, pending the outcome.

On Monday evening, Chairman J. B. John of the Committee on Accident Prevention, gave his annual dinner to the delegates of the winning mills at Hotel Commodore. Approximately sixty persons were present. In his address Mr. John recalled the progress made by the industry in avoiding injury to its workers and viewed the many good effects of this movement as the greatest benefits yet conferred by the Portland Cement Association.

In discussing the significance of the Portland Cement Association trophy for the elimination of accidents, Mr. John said:

"Fully 90% of the beautiful and costly monuments erected in public squares and parks commemorate the victories of warriors whose business was to kill. I am extremely happy that our great cement fraternity is erecting these many splendid monuments to the men who are so faithfully laboring to save life. I have the deep conviction that no man can engage in this kind of unselfish effort without receiving, sooner or later, a bountiful reward. Many of us feel that we have it already, but it is bound to overtake all who help in stamping out these causes of misery and distress."

Practically all of the delegates spoke briefly during the evening. They were seated at the table in order of their seniority, those who had served the industry longest being seated closest to Mr. John. Enthusiasm was at a high pitch and the meeting continued until 11:15 P. M.

The delegates from the winning mills (whose photographs appeared in Rock Products for May 24) were also guests of honor at the formal dinner of the Portland Cement Association on Tuesday evening, May 27, in the grand ballroom at the Biltmore and at luncheon with the members of the association in the same hotel on Wednesday, May 28.

Accident Prevention Session Impressive

On Wednesday afternoon at 2 o'clock occurred the accident prevention session in the Music room at the Biltmore, presided over by Frank H. Smith of the association and with Vice-President Charles L. Hogan, Treasurer Charles E. Ulrickson, and Secretary William M. Kinney on the rostrum.

After reading, the report of the Committee on Accident Prevention was adopted and the chairman then introduced Daniel Harrington, chief engineer of the United States Bureau of Mines, acting on behalf of the Joseph A. Holmes Safety Association. In presenting the Portland Cement Association with the Joseph A. Holmes certificate of award for conspicuous progress in the prevention of industrial accidents, Mr. Harrington said:

"In connection with this particular award, I presume you would be curious to know something about the organization which is giving it. The United States Bureau of Mines was brought into existence in 1910 through Congressional action. There was a desire on the part of Congress and of the mining industry in general to try to do something to reduce the extremely bad accident record of the mines of the United States.

"Immediately before the establishment

of the Bureau of Mines there had been a series of extremely disastrous mining accidents with an enormous loss of life, and it was this thought primarily that brought the Bureau of Mines into existence.

"The first director of the Bureau of Mines was Dr. Joseph A. Holmes, who had previously done a considerable amount in trying to make the mines of the United States safe. Dr. Holmes was an outstanding character in many respects, but particularly was he outstanding in his work in safety.

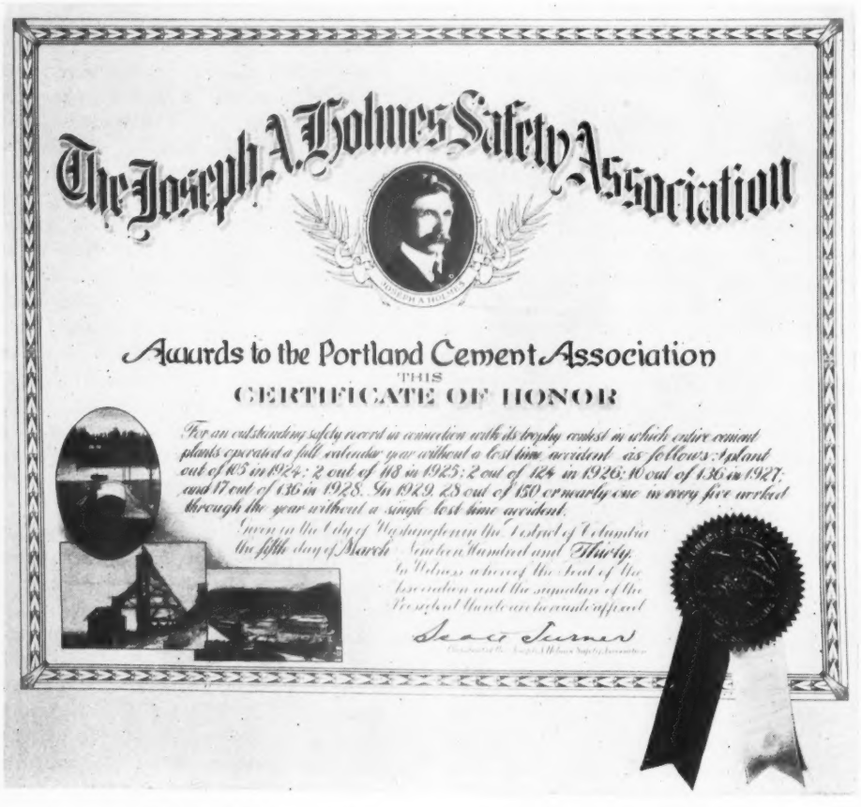
"He died in 1915 and almost immediately there was started a movement to commemorate his life services. This movement was participated in by a number of organizations and they established what is now known as the Joseph A. Holmes Safety Association. These organizations are as follows:

"The American Association for the Advancement of Science, the American Ceramic Society, the American Federation of Labor, the American Institute of Mining and Metallurgical Engineers, the American Mining Congress, the American Red Cross, the American Society for Testing Materials, the American Society of Mechanical Engineers, the Coal Mining Institute of America, the Geological Society of America, the Holmes Safety Association, which is a different organization from the Joseph A. Holmes Safety Association, the International Railway Fuel Association, the Mine Inspectors Institute of America, the National Coal Association, the National Safety Council, the Personnel Research Federation, the Smithsonian Institution, the Society for the Promotion of Engineering Education, the United Mine Workers of America, the United States Bureau of Mines and the United States Geological Survey.

ESTABLISHMENTS, EXPOSURE AND ACCIDENT RATES, BY INDUSTRIES, 1929
(Arranged in order of frequency rates, from high to low)

Industry	Number of establishments	Hours of exposure	Rates Frequency	Rates Severity
Total*	3,603	5,058,942,337	25.53	2.23
Mining	162	82,095,942	74.43	9.99
Meat packing	18	102,832,500	55.94	1.47
Construction	397	127,344,439	50.41	4.62
Refrigeration	44	20,255,495	43.35	3.04
Woodworking and lumbering	222	160,257,172	42.83	3.59
Tanning and leather	34	28,552,020	31.35	1.60
Foundry	229	409,795,710	30.30	1.73
Electric railways	46	78,445,722	29.75	1.93
Metal forming	347	324,732,946	29.71	1.67
Ceramic	42	19,301,791	28.93	1.07
Paper and pulp	215	196,881,082	28.43	1.77
Petroleum	79	565,701,537	26.78	2.49
Quarry	125	18,011,588	26.71	6.11
Non-ferrous metallurgical	26	37,515,661	23.16	2.71
Public utility	403	589,150,210	22.58	3.13
Automobile	67	346,572,274	22.17	.97
Railway car and equipment	37	69,096,822	21.88	2.20
Food	171	137,278,278	21.07	1.50
Rubber	42	175,157,500	19.25	1.24
Machinery	212	448,821,236	18.91	1.11
Steel	128	567,248,244	18.13	2.75
Glass products	17	20,452,053	17.70	.80
Chemical	172	206,439,640	17.50	1.72
Laundry	34	10,174,088	12.78	1.53
Printing and publishing	20	14,059,389	12.23	.67
Textile	153	199,749,575	11.82	.58
Cement	138	75,739,429	9.55	3.64

*Includes also miscellaneous industries.
(From Annual Report on Industrial Accidents by National Safety Council)



Photographic reproduction of the Holmes Safety Award

"In the handling of the organization, we try to keep in touch with the safety movement throughout the United States, particularly with reference to mining. We involve or include the cement industry in mining because of the fact that under the law giving the Bureau of Mines existence, it was stated that the bureau would be concerned with mining and allied industries, and in this we include the portland cement industry. To date this year we have trained more than eighty thousand men in first-aid and we expect fully to have reached more than one hundred thousand persons by the 30th of June of this year.

Praises Industry's Safety Record

"We have been keeping in touch with the safety work in which you people have been engaged and, as a comparative outsider, I think I can truthfully say that there isn't an industry in the United States which has made as much progress in safety as you people, and in that we can add to the statement that there are few, if any, industries in the United States which are now being conducted with as great a degree of safety as yours.

"You people have done an enormous amount of good to the mining industry without knowing it. Up to about five years ago there were very, very few, indeed, mining companies in the United States who looked upon accidents in any light other than that of fatalities. Every mining man figured that every mine had to have accidents, that they were inherent in the industry, and in general the mining company which could escape going through the year without having had one,

two or more fatalities was lucky. As far as trying to operate a mining property, large or small, for any considerable period without lost-time accidents, that was simply out of the question.

"Largely on account of the fine record which your industry has made, the excellent example which you have set, the mining industry is beginning to think in terms of no lost-time accidents. For instance, we have the record of a coal mine in Pennsylvania, operated by one of the subsidiaries of the United States Steel Corporation, which went through a sixteen-month period recently without a lost-time accident and the number of men involved was approximately two hundred. That is one of the greatest achievements which has ever been brought about in the mining industry in safety.

"For thirty years much of my activity has been in connection with safety in mines, and the main point of resistance which we find in mine safety is the fact that only too generally the higher men, the operating officials, are inclined to look upon the safety side of mining as either a fad or an impossibility. In other words, they are more or less fatalists.

"They think that as long as mining has to be conducted that there are going to be accidents and while they might do a certain amount towards trying to prevent those accidents, they don't get into it with the idea of preventing them, at least not to anything like the extent which your executives do, apparently. That is another thing in which I think your organization is setting the pace for the other industries, and I wish to congratulate the heads of the cement companies very much on their attitude.

"I will give you essentially the reading of the certificate as the basis upon which it was awarded:

" 'The Joseph A. Holmes Safety Association awards to the Portland Cement Association this certificate of award for its excellent safety work and safety record in connection with its trophy contest, in which one cement plant out of 105 went through the year of 1924 without a lost-time accident; two plants out of 118 had no lost-time accident in 1925; two out of 124 in 1926; 10 out of 136 in 1927; 17 out of 136 in 1928, and 27 out of 153 or nearly one in every five went through the year 1929 without a lost-time accident.' "

Gabriel S. Brown, president of the Alpha Portland Cement Co., past president of the Portland Cement Association and for many terms treasurer and director, accepted the Holmes award on behalf of the association and its member mills. Chairman J. B. John was then called upon to conduct the formal presentation of the trophies awarded to member mills for perfect safety record in 1929. Mr. John said:

"As a very appropriate sequel to the Holmes presentation, we are now about to formally award the Portland Cement Association Safety Trophy for 1929 to those mill organizations which, by reason of completing last year's operation without an accident, produced the record for our industry which won the Holmes award.

Safety Work Shows Progress

"Two years ago when we gathered here for a similar purpose our surprise and admiration was attracted by a group of 20 delegates representing 10 successful mills. Four of these mills are represented here again today. One year we were confronted with a much larger group consisting of 34 men representing 17 successful mills. Of the plants represented here a year ago, seven also have their delegates among the number now before me. That is progress.

"But it is difficult for us to adequately express our gratification on this occasion when there have assembled here in response to the challenge implied in our contest, a company of over 50 of the picked men of our industry, representing as many mills as the total for the two preceding years."

A. J. R. Curtis, secretary of the Committee on Accident Prevention, read the list of winning mills and delegates as recently presented in ROCK PRODUCTS, the audience applauding as each man arose. Mr. John then continued:

"It is now my pleasure, acting on authority of the board of directors, and on behalf of every member of the Portland Cement Association, to announce that the complete accident records of these mills have been canvassed under my direction and that all of them have been found entitled to, and are hereby awarded, the Portland Cement Association Safety Trophy for perfect safety records in 1929.

"The records of these mills are magnificent and on behalf of our entire industry I extend congratulations.

"The actual trophies, far too large to be presented here, are being shipped to your respective plants to be erected and dedicated later. Plants which have won this award previously will have their present trophies suitably reinscribed. As a slight token of this award and as a remembrance of this occasion each delegate will now receive a platinum print of the trophy."

Mr. John then presented each delegate with a large encased print of the trophy. Because of the impracticability of hearing from all of the long list of delegates, the chairman called upon the following, who made responses on behalf of the entire group: O. B. Potter, master mechanic, Universal Atlas Cement Co., Duluth, Minn.; Samuel P. Helfrich, assistant general foreman, Lehigh Portland Cement Co., Ormrod, Penn.; O. H. Enax, chief electrician, Lone Star Cement Co., Virginia, Norfolk, Va.; Henry A. Stenger, master mechanic, Cowell Portland Cement Co., Cowell, Calif.; A. E. Flowers, Jr., plant chemist and safety director, Trinity Portland Cement Co., Houston, Tex., and Ernest M. Ayres, chief operating engineer, Hercules Cement Corp., Stockertown, Penn.

Interest in the occasion was added by the reading by Chairman Smith of a telegram received during the session from the Cowell Portland Cement Co., in California, announcing the successful completion of four years' operation without lost-time accident, another new record.

Lehigh Valley Cement Men Hold 14th Annual Safety Conference

THE FOURTEENTH ANNUAL safety conference of the cement mills of the Lehigh Valley was held under the auspices of the Portland Cement Association at Hotel Easton, Easton, Penn., on Thursday, May 29. In points of attendance and interest the meeting was one of the best that has been held.

Fred B. Hunt of the Nazareth Cement Co. acted as chairman of the committee on arrangements and W. W. Hamilton of the Alpha company presided during the afternoon session. The enrollment included representation from 23 local mills and there were also present, as invited guests, about 20 delegates from mills which won the Portland Cement Association trophy last year. The program:

Afternoon Session

"A Few Remarks from Headquarters"—A. J. R. Curtis, Portland Cement Association.

Introduction of the visiting delegates by Mr. Curtis.

"What Can We Do to Better Our Accident Record?"—C. W. Jeffers, associate engineer, U. S. Bureau of Mines.

"Good Housekeeping Plays Its Part in Making Plants Safe"—Frank Leh, master mechanic, Lone Star Cement Co., Nazareth, Penn.

"What Are the Best Methods to Be Used by Foremen in Promoting Safety"—R. B. Fortuin, assistant to general manager, Pennsylvania-Dixie Cement Corp., Nazareth, Penn.

"How Should Safety Regulations Be Enforced?"—G. B. Searles, chairman of Safety Committee, Nazareth Cement Co.

"Some Marks of Recent Progress"—Lieut.-Col. H. A. Reninger, Lehigh Portland Cement Co., Allentown, Penn.

"Safety on a Broader Basis"—Col. E. C. Spring, Lehigh Valley Transportation Co.

"Gateman Bill"—A safety playlet by Junior Dramatic Club, Easton High School.

Dinner—Evening

Toastmaster, Marion S. Ackerman, Jr., superintendent, Lawrence Portland Ce-

ment Co., Siegfried, Penn.

Speakers: A. J. R. Curtis, assistant to general manager, Portland Cement Association, and Dr. Theodore Grayson, dean of Wharton School of Finance, University of Pennsylvania.

Mr. Jeffers' Address

In his address Mr. Jeffers said:

"To those who have been interested in the great safety movement which has swept the country the last few years there has come the realization that accidents do not just happen and that there are better ways to avoid injury than by merely dodging. We are confronted with the fact that there is reason, a responsibility, and a means of prevention for each accident.

"Accident-free operation may not be attainable in a world in which familiarity breeds indifference and contempt for known hazards and in a world in which we have stubborn, careless, reckless and thoughtless individuals. Many of us persist in saying that as long as we have industry we will have accidents as an excuse for each accident as it occurs. Some of the wonderful performances being turned in today in industry along the lines of safety make it pertinent to inquire whether we do not use the natural hazard idea to cloak human and mechanical failings.

"Safety in an organization must originate in the management and be instilled in the mind of each employe before we can approach that goal of no-accident operation. When each individual strives to be a safe worker regardless of his position in the company, then we can expect real results in accident prevention. After we have this determination to eliminate accidents, then we have certain steps through which we may go to build up this safety spirit, and to do this we must have the co-operation of the personnel.

"Perhaps the first thing to be done is to find out what are the causes of the accidents which are occurring. They should be so recorded that a thorough analysis can be made. A close study of such a record should reveal these causes and put us in a position to eliminate them.

"The success or failure of an accident prevention program rests largely with the foreman. He must use common-sense, logic, initiative and, last but by no means least, in so far as safety is concerned, he must be willing to accept responsibility. He is in a position to know the men who work for him; he can instruct and train them, and can correct improper practices before they cause trouble.

"Accidents are just as much his responsibility as any other phase of his work, which includes production, discipline, order, morale and good housekeeping. It has been estimated that from 75% to 90% of the accidents which occur are attributed to supervisory conditions within the control of the foreman.

"A measure of the success of an accident prevention program is the amount of responsibility the management and foreman are willing to assume for accidents, not the number of excuses or reasons they can think up to explain them. In training men for foremen jobs they should be taught to assume this responsibility for accidents as well as for any other division of their work. Any man who aspires to better things should not forget that fear to accept responsibility keeps more men in subordinate positions than any other factor.

"There are several things that first-aid training does to stimulate safety:

1. It fosters thinking in terms of safety.
2. It makes a man think of the cost of an accident in physical pain to himself.
3. It teaches him how accidents occur and how they can be avoided.
4. It gives him an understanding of the makeup of the body.
5. It trains him to care for the injured and the satisfaction gained from an act of this kind cannot be measured.

"F. J. Chesterman, vice-president and general manager of the Bell Telephone Co. of Pennsylvania, in a recent statement said: 'First-aid is one of our most important accident prevention activities.' It has been found that first-aid men are not the ones who sustain injuries, so why not have all employes first-aid men?

"For the promotion of safety, health and welfare in and about various operations it has been found extremely helpful to sponsor a local safety organization. We must give safety lots of publicity and an organization of this kind can do much toward this end. The work of the Holmes Safety Association in promoting and sponsoring safety organization and as a medium for bettering safety, health and welfare conditions cannot be too highly praised."

Los Angeles Cement Plant Controversy Apparently Closed

THE CONTROVERSY as to whether Alphonso Bell and associates should or should not be allowed to open a quarry in the Santa Monica mountains, in the Beverly Hills-Hollywood district of Los Angeles, Calif., appears to be about over. The question has been agitated pro and con for over a year, and miles of newspaper columns have been devoted to it. The scheme proposed was to quarry limestone in these hills and pump the dust or slurry to a cement plant at tidewater, some four miles away.

The prospective neighbors of the proposed quarry fought the project in every conceivable way, but largely in the local newspapers. The issue is still before the California supreme court.

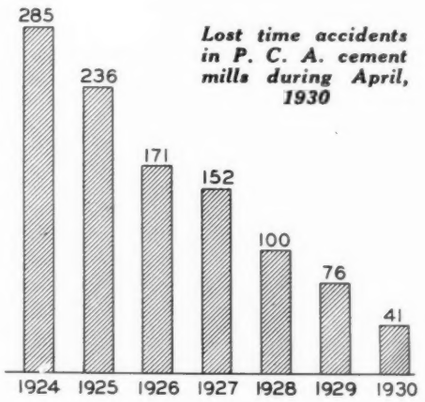
It is now reported that Mr. Bell and associates have accepted $10,000,000 for their property holdings of some 14,000 acres, and that this property will now be turned into a high-class real estate development.

April Accidents in Cement Mills Take Decided Drop

PERSONAL INJURY accidents in the cement mills within Portland Cement Association membership took a decided drop during April. The total for the month included only 41 lost time mishaps, as against 76 similar accidents during April, 1929, a decrease of 46%. Successive decreases in April accidents during the last seven years are shown in the accompanying graph.

April was the first month for approximately two years during which there were no fatal accidents. Production for the month was high and for the first four months of 1930 was less than 2% below that for the corresponding period last year, according to U. S. Bureau of Mines reports.

Eighty mills out of a total of 160 mills reporting finished the period from January 1 to May 1 without the loss of a day's time or any permanent disability or fatality, the same number as finished the similar period safely last year.



Lost time accidents in P. C. A. cement mills during April, 1930

The most severe accident of the month occurred when a crane operator, lowering the boom of an excavator, caught his hand between a sheave and the guard, cutting off one finger and severing the tendon in another. In a second permanent disability accident a laborer reached up to pull a rope in order to unhook a concrete buggy being used in constructing a concrete floor for a belt conveyor incline. The man operating the winch mistook the laborer's movement for a signal to go ahead and started winch, pulling laborer's finger into sheave. It was cut off at the second joint.

Quarry work claimed another victim to falling rocks. A driller was struck and knocked to the quarry floor, breaking a leg and inflicting severe cuts about the face. A laborer was working a hand windlass to raise a boom chute over a barge when crank handle got away from him, and struck him in the face, fracturing cheek bone and causing abrasions.

Proposed Standard Government Purchase Specifications for Quicklime

THE Federal Specifications Board of the Bureau of Standards, Washington, D. C., is sending out to manufacturers and others interested, for their comment and criticism, proposed revisions and standardization of government purchase specifications. "Federal Specifications No. 250, for Quicklime for Structural Purposes," lists two types and the general and detail requirements of quicklime for structural purposes, and gives methods of sampling, inspection and tests, as well as packaging, packing and marking.

"Federal Specification No. 553, for Metal Bases for Plaster and Stucco Construction," lists the various types of metal lath and wire fabric for this use, and gives general and detail requirements covering these materials, and the methods of inspection and test.

Copies of these as well as an alphabetical index of all federal specifications may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a cost of five cents each.

The Federal Specifications Board would be glad to receive any comments or suggestions as to changes which may be thought to be desirable in these specifications, and such comments or criticisms should be received by the board not later than six weeks from May 17, in order to receive attention.

Proposed Lime Specifications

QUICKLIME

B. TYPES

B1. Quicklime sold under this specification may be of either of two types: Type C, Calcium; Type M, Magnesium.

C. MATERIAL AND WORKMANSHIP

C1. Quicklime sold under this specification shall be well burned from a good quality of limestone, dolomite, marble or shells.

D. GENERAL REQUIREMENTS

D1. Quicklime shall be reasonably free from ashes, core, overburned lime, or similar deleterious foreign matter.

E. DETAIL REQUIREMENTS

E1. Type C (calcium) lime shall contain not less than 75% calcium oxide.

E2. Type M (magnesium) lime shall contain not less than 20% magnesium oxide.

E3. *Chemical Composition*—The quicklime shall conform to the following requirements as to chemical composition, calculated to the nonvolatile basis:

Calcium and magnesium oxides, minimum	95%
Silicon, aluminum and iron oxides, maximum	5%
Carbon dioxide, maximum:	
If sample is taken at the kiln	3%
If sample is taken elsewhere	10%

E4. *Waste*—When tested in accordance with the method given below, the quicklime shall contain not more than 3% by weight of waste.

F. METHODS OF SAMPLING, INSPECTION AND TESTS

F1. *Sampling.*

F1a. In sampling bulk lime 10 shovelfuls (not less than 100 lb.) shall be selected from different parts of the car by an inspector. This shall be broken, if necessary, so that it will all pass a 1-in. ring. It shall be mixed and quartered to obtain a final sample of 15 lb. This shall be divided into three equal parts and each part shall be sealed in an air-tight container.

F1b. In sampling lime in barrels 2% of the number of containers (but never less than five barrels) shall be opened and their contents dumped in a pile. This pile shall then be sampled as under F1a.

F1c. Sampling shall be done as expeditiously as possible in order to avoid undue exposure of the material to the air.

F1d. One of the triplicate samples shall be sent to the consignor, one to the consignee, and the third shall be held for retest in case of dispute. Samples shall not be taken from broken packages.

F2. *Inspection and Tests.*

F2a. *Chemical Analysis.*

F2a(1). Remove one-quarter of the sample as received, taking precautions to insure that the quarter is representative of the whole sample. Reverse the remaining three-quarters for the waste determination, F2b. Crush the quarter removed, so that it will all pass a No. 8 sieve, mix thoroughly and quarter. Crush this sample so that it will all pass a No. 20 sieve, mix thoroughly and quarter. Crush all of this last quarter so that it will all pass a No. 100 sieve, mix thoroughly and place in an air-tight container until analyzed.

F2a(2). Weigh out 0.5 g. of the material and transfer to a platinum or porcelain evaporating dish. Mix to a thin slurry with distilled water, add 5 to 10 cc. of HCl (sp. gr. 1.20) and digest with gentle heat and agitation until solution is complete. Evaporate this to dryness so far as this may be possible on the water bath.

F2a(3). *Silica*—Heat the dish and its contents [see F2a(2)] in a drying oven for one hour at 110 to 120 deg. C. Drench the cooled mass with 20 cc. dilute HCl (1:1) and heat on the water bath for 10 minutes. Add an equal volume of water. Filter. Wash the residue thoroughly, first with dilute HCl and then twice with cold water. Evaporate the combined filtrates to dryness. Extract with HCl as before, filter through a second paper and wash as above. Save the filtrate. Place both filter papers and their contents in a platinum crucible and ignite to constant weight. Add 5 cc. of HF and two drops of concentrated H_2SO_4 to the ignited residue. Evaporate to dryness, ignite for two or three minutes, cool, and weigh again. Record the loss of weight as silica.

F2a (4). *Iron and Aluminum Oxides*—Fuse the residue remaining in the platinum crucible after the HF treatment [see F2a(3)] with 0.2-0.3 g. Na_2CO_3. Dissolve the cooled melt in HCl and add the solution to the filtrate obtained in the silica determination. Add a few drops of bromine water or HNO_3 and boil to remove excess of bromine or chlorine. Then add HCl, if necessary, to insure the presence of 10 cc. of concentrated acid. Add a few drops of methyl red solution, dilute to 200 cc. and boil. Nearly neutralize with concentrated NH_4OH. Complete the neutralization with dilute ammonia (1:3), adding it slowly until the color of the liquid just changes to a distinct yellow. Boil for one or two minutes, allow to settle, filter, and wash two or three times with a hot 2% solution of NH_4Cl. Transfer the paper and precipitate to the beaker in which the precipitation was made. Add 10 cc. concentrated HCl, macerate the paper, dilute to 200 cc., boil, and reprecipitate with NH_4OH as described above. Filter into the beaker containing the first filtrate and wash as previously described. Ignite the precipitate in a platinum crucible and weigh as oxides of iron and aluminum.

F2a(5). *Calcium Oxide*—To the filtrate from the iron and aluminum determination [see F2a(4)] add a few drops of NH_4OH and boil. Add 35 cc. of a saturated solution of ammonium oxalate and continue the boiling until the precipitated calcium oxalate assumes a granular form. Allow to stand 20 minutes or until the supernatant liquid is clear. Filter and wash thoroughly with hot water. Ignite the precipitate in a platinum crucible. Dissolve in hot dilute HCl and make up to 100 cc. with water. Add a slight excess of NH_4OH and boil. If any aluminum hydroxide separates out, filter, wash with 2% NH_4Cl, ignite, weigh, and add this weight to the oxides of iron and aluminum determined previously. Precipitate with ammonium oxalate as before. Filter, and combine the filtrates from the two filtrations. Ignite the precipitate to constant weight in a platinum crucible, and weigh as calcium oxide.

F2a(6). *Magnesium Oxide*—Acidify the combined filtrates from the calcium precipitates with hydrochloric acid, concentrate on the steam bath to about 150 ml. and make slightly alkaline with ammonium hydroxide, boil and filter (to remove a little iron and aluminum, and perhaps calcium). When cool acidify the solution with hydrochloric acid, add 10 ml. of saturated solution of sodium-ammonium-hydrogen phosphate, and ammonia, drop by drop, with constant stirring. When the crystalline ammonium-magnesium orthophosphate has formed add 10 ml. of ammonia in excess. Set the solution aside overnight in a cool place, filter, and wash with water containing 2.5% NH_3. Dissolve the precipitate in a small quantity of hot hydrochloric acid, dilute the solution to about 100 ml., add 1 ml. of a saturated solution of sodium-ammonium-hydrogen phosphate and ammonia, drop by drop, with constant stirring, until the precipitate is again formed as described above and the ammonia is in moderate excess. Allow the precipitate to stand about two hours; filter and wash as before. Place the paper and contents in a weighted platinum crucible, char the paper slowly, and carefully burn off the resulting carbon. Ignite the precipitate to constant weight over a Meeker burner, or a blast not strong enough to soften or melt the pyrophosphate. Multiply this weight by 0.3621 to find the weight of magnesium oxide.

F2a(7). *Carbon Dioxide*—Weigh out a 5-g. sample and transfer it to a small Erlenmeyer flask. Put this flask in a carbon dioxide train composed as follows: After the flask comes an upwardly inclined condenser, then U-tubes containing $CaCl_2$, anhydrous $CuSO_4$ and $CaCl_2$, then a U-tube filled with porous soda lime, and finally a U-tube containing half soda lime and half $CaCl_2$, ar-

ranged so that the $CaCl_2$ comes last. Pour some hot water on the sample, connect the flask to the train, and pass a current of CO_2 free air through all of the train excepting the two soda-lime tubes. Close, weigh, and attach the soda-lime tubes. Through a separatory funnel, let some 1:1 HCl into the flask slowly. When any apparent action has ceased, heat the flask gradually to boiling, and continue boiling until no more gas is evolved. Cool gradually. The current of CO_2 free air is continued throughout the experiment. Detach the soda-lime tubes, close, and let them stand in the balance case, weighing them at 30-minute intervals until two successive weighings agree with 0.5 mg. The gain in weight of the soda-lime tubes is recorded as the weight of the carbon dioxide.

F2a(8). *Nonvolatile Matter*—Weigh out a 1-g. sample and ignite to constant weight in a platinum crucible. The weight of the material left is the weight of the nonvolatile matter.

F2a(9). *Calculations* — The weights in grams of the oxides of silicon, iron, aluminum, calcium and magnesium, as found above, are multiplied by 200 to reduce them to percentages. The weight of the carbon dioxide in grams is multiplied by 20. All of these figures must then be divided by the weight of the nonvolatile matter as found in the preceding paragraph to reduce them to the nonvolatile basis called for in the table of requirements.

F2b. *Waste.*

F2b(1). After the sample for chemical analysis has been set aside all of the rest of the sample as received shall be screened on a No. 3 sieve. Weigh the lime retained on the sieve and transfer it to a slaking box. This lime is then slaked by an experienced operator to produce the maximum quantity of putty, care being taken to avoid "burning" or "drowning" the lime. Cover the box to prevent evaporation and let stand 24 hours. Transfer the putty to a No. 20 sieve, and wash it through the sieve with a stream of water from a hose. This operation must be completed within 30 minutes. The sieve and the residue contained thereon are then dried to constant weight in a current of CO_2 free air at a temperature of 110 to 120 deg. C. The dry weight of this residue is divided by the weight of the lime slaked, multiplied by 100, and the result reported as "per cent waste."

G. PACKAGING, PACKING AND MARKING

G1. Any special requirements of individual departments are noted under Section H.

G2. *Packaging*—Unless otherwise specified, commercial packages are acceptable under this specification.

G3. *Packing*—Quicklime may be delivered in bulk if in carload lots, otherwise it shall be delivered in barrels holding 180 or 280 lb. each.

G4. *Marking*—Each barrel of lump lime shall be legibly marked with a description of the contents, the name of the manufacturer, the place of manufacture, the brand (if any), the net weight of the contents, and some means of identification of the particular contract on which purchase and shipment were made.

Each carload of bulk lime shall carry the above information on a card conspicuously posted inside the car.

Most of the above marking is required by the Federal Lime Barrel Act, Public No. 228, Sixty-fourth Congress.

H. REQUIREMENTS APPLICABLE TO INDIVIDUAL DEPARTMENTS

H1. The following departmental specifications, of the issue in effect on date of invitation for bids, shall respectively form a part of this specification:

H1a. Army: U. S. Army specification No. 100-2, Standard Specification for Marking Shipments.

H1b. Navy: Navy Department General Specification for Inspection of Material.

H1c. Marine Corps: Instructions issued by the Quartermaster's department.

I. NOTES

I1. It is believed that this specification adequately describes the characteristics necessary to secure the desired material, and that normally no samples will be necessary prior to award to determine compliance with this specification. If, for any particular purpose, samples with bids are necessary, they should be specifically asked for in the invitation for bids.

I2. This specification governs all United States Government purchases of this commodity.

Bauxite Industry in 1929

SHIPMENTS OF BAUXITE from mines in the United States in 1929 were 365,777 long tons, valued at $2,265,638, a decrease of 2.6% in quantity and of 0.4% in total value, as compared with 1928, according to a statement of the United States Bureau of Mines, Department of Commerce.

DOMESTIC BAUXITE SHIPPED BY PRODUCERS TO INDUSTRIES IN THE UNITED STATES, 1925-1929, IN LONG TONS

Year	Aluminum	Chemical	Abrasive	Cement and refractory	Total
1925	173,040	67,420	73,720	260	314,440
1926	241,850	77,960	72,710	230	392,250
1927	186,490	62,410	71,790	250	320,940
1928	218,398	83,992	72,931	105	375,426
1929	172,807	86,419	99,925	6,626	365,777

BAUXITE (INCLUDING BAUXITE CONCENTRATES) EXPORTED FROM THE UNITED STATES, 1925-1929

Year	Long tons	Value
1925	78,633	$4,134,455
1926	87,770	4,741,260
1927	121,858	7,800,491
1928	112,984	5,210,912
1929	133,551	3,926,283

The producers of domestic bauxite reported sales during 1929 at prices ranging from $5 to $8.50 a long ton. The average for Arkansas bauxite was $6.21 a ton, for Alabama $5.95 and for the United States $6.19. Probably the values reported to the Bureau of Mines by most operators represent nearly production costs, as the greater part of the domestic bauxite is produced by consumers of bauxite. The quoted prices[1] for bauxite were as follows: Domestic: No. 1 chemical ore, crushed and dried, 55 to 58% Al_2O_3, and 1.5 to 2.5% Fe_2O_3, $7.50 to $8.25 a long ton f.o.b. Alabama and Arkansas mines; foreign: Dalmatian bauxite, 50 to 55% Al_2O_3 and 1 to 3% SiO_2, $4.80 to $6.50; Istrian, 54 to 57% Al_2O_3 and 3 to 5% SiO_2, $5.50 to $7, and French, 56 to 59% Al_2O_3 and 2 to 5% SiO_2, $6 to $8 a metric ton c.i.f. New York.

BAUXITE SHIPPED FROM MINES IN THE UNITED STATES, 1925-1929

Year	Georgia, Alabama* and Tennessee Long tons	Georgia, Alabama* and Tennessee Value†	Arkansas Long tons	Arkansas Value†	Total Long tons	Total Value†
1925	20,220	$109,800	296,320	$1,878,450	316,540	$1,988,250
1926	20,680	116,650	371,570	2,298,550	392,250	2,415,200
1927	17,110	95,920	303,830	1,892,860	320,940	1,988,780
1928	14,190	80,668	361,236	2,193,230	375,426	2,273,898
1929	14,723	84,480	351,054	2,181,158	365,777	2,265,638

*No production from Alabama in 1925 and 1926, and no production from Tennessee in 1927 and 1929.
†Value f. o. b. mines.

In Alabama bauxite was produced in 1929 from the Eufaula and "Lennig" mines, in Barbour county, and the Davis Hill, No. 3, mine, in Henry county. The shipments were 70% more than in 1928, of which half was shipped for use in the abrasive industry and about half for use in the chemical industry.

Bauxite was produced in Georgia in 1929 at the Dupont mine in Floyd county, and the Lane McMichael mine, in Macon county. Shipments from Georgia in 1929 were 53% less than in 1928, all of which was shipped for use in the chemical industry.

In 1929 bauxite was produced in Arkansas at five mines—the Sweet Home, Dixie No. 2, and Hoekstra mines, in Pulaski county, and the Bauxite and Superior mines, in Saline county. Shipments of bauxite from Arkansas in 1929 were 351,054 long tons, a decrease of 3% from 1928. The main production originated in the Saline county field, in which there was a decrease of 5%, but the mines in Pulaski county shipped important quantities, the increase over 1928 being 8%. The shipments from Arkansas were mainly for use in the aluminum industry, followed in order by the abrasives, chemical and refractories industries.

[1]*Engineering and Mining Journal*, Vols. 127 and 128, 1929.

Asphalt Institute Has New Address

THE ASPHALT INSTITUTE, of which J. E. Pennybacker is managing director, is now located in the new Crystal building, 43rd street and Second avenue, New York City, where offices and laboratories occupy the entire 18th floor. The Asphalt Institute succeeded the Asphalt Association on January 1, 1930.

SUPPLY OF BAUXITE IN THE UNITED STATES, 1925-1929

Year	Domestic shipments Long tons	Domestic shipments Value	Imports Long tons	Imports Value	Total new supply Long tons	Total new supply Value
1925	316,540	$1,988,250	353,696	$1,549,120	670,236	$3,537,370
1926	392,250	2,415,200	281,644	1,187,497	673,894	3,602,697
1927	320,940	1,988,780	356,580	1,572,236	677,520	3,561,016
1928	375,426	2,273,898	350,111	1,534,498	725,537	3,808,396
1929	365,777	2,265,638	380,812	1,753,840	746,589	4,019,478

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Successful Transit Mix Concrete

By R. M. Bell
Portland, Ore.

THERE is probably no one thing in the construction industry today that is attracting the attention of so many people, and being investigated so thoroughly, as the problem of delivery of concrete to the construction job ready to be poured into the forms, that is, in other words, ready-mixed concrete. There is probably no firm more competent, nor one that has put such an industry more into full operation and made more of a complete success of delivery of certified strength concrete, than the Yett transit system, operated for the past two years in Portland, Ore.

A recent achievement of the company was the receiving of the contract from the Gilpin Construction Co., Portland contractors, who have the contract for the pier work on the new St. Johns bridge across the Willamette river in Portland, for the furnishing of transit-mixed concrete for the piers, cable anchorages, abutments, and retaining walls, for this $11,000,000 bridge. Approximately 60,000 cu. yd. of concrete will be poured on this structure.

In order to insure the very best of service and prompt delivery and continuous pouring when necessary, a portable charging plant, which has recently been perfected by Porter W. Yett, manager of the company, was installed on the dock of the Willamette river at the foot of Richmond street in St. Johns, from which the transit mixer trucks will receive their loads and have only a half-mile haul. The designing engineers, Robinson and Steinman, New York City, have viewed the Swigert, Hart and Yett, Inc., Co.'s plant and placed their approval on this method of delivering the concrete for this bridge, which will be the largest suspension bridge west of the Mississippi river, total length, 3,833 ft., with a clearance height of 203 ft., being the highest in the world to cross a navigable river.

A branch of the Swigert, Hart and Yett Co., a sand and gravel corporation, that has been in operation for the past 19 years in Portland, the Yett transit system has perfected a concrete-mixing and proportioning plant which guarantees perfectly mixed concrete, far above the standard quality, at a very reasonable price. Through the efforts of Mr. Yett, perfection of certain devices have been reached in such a manner as to insure the best possible mixed concrete, and a means has been developed to avoid delays in loading and measuring the aggregates, so

Part of the fleet of transit mixer trucks in front of the portable charging plant

that the product has a guaranteed certified strength when delivered to the job.

Crushed Rock Quarry

Starting operating in Portland in 1910, Porter W. Yett organized the City Motor Trucking Co., a trucking concern which was one of the first companies in the United States to use motor trucks for hauling paving material. This company in 1921 started operating a rock quarry and a paving contracting business in connection with the City Motor Trucking Co.'s business. At the present time the quarry property consists of 80 acres of land owned by the company, and 55 acres leased for a number of years. The rock from this quarry is a high grade blue basalt, and up to the present time approximately 500,000 cu. yd. of rock has been used and sold by this concern. It is estimated that the raw material in the quarry property is approximately 2,000,000 cu. yd.

The number of men employed at the quarry averages nine, and they have entire care of everything connected with the blasting, quarrying and crushing of the stone. Located as it is 16 miles from Portland on the Old Oregon Trail highway, the Astoria branch of the Spokane, Portland and Seattle railroad, and the Willamette river, it is provided with all kinds of transportation. The average of crushed stone sold during the year is approximately 50,000 cu. yd. A fleet of nineteen trucks care for this business in connection with the sand and gravel operations.

Transit-Mixed Concrete Plant

It was during 1928 that Porter Yett organized the Swigert, Hart and Yett Co.'s transit mixed concrete plant, converting eight of the 19 trucks into transit mixer trucks and buying four new Federal trucks, and due to the rapid growth of the business, and the increasing demand for transit mixed concrete, the transit mix fleet has been increased to sixteen.

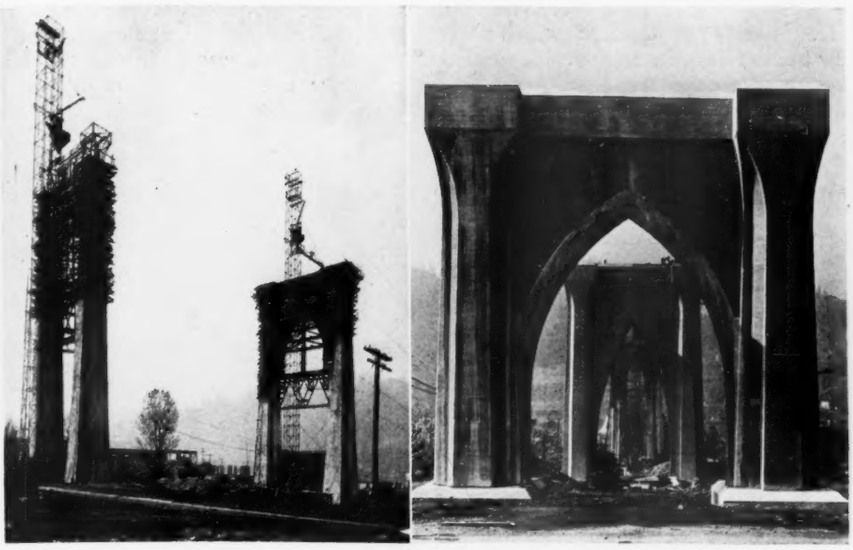
Transit mixer truck in position to discharge load

The large cylinder painted with wide blue and white stripes, mounted on the truck chassis, has become a very familiar sight on the Portland streets, day and night, as the popularity of the concrete increases. For the first time in Portland, guaranteed strength concrete is available for the contractor, with none of the usual muss and traffic congestion formerly experienced with the use of small concrete mixers. Recently a building constructed in the downtown congested area used "Perfect Mix" concrete, and the only space used in the street was the platform upon which the trucks backed to discharge the load, taking up a space of 3 ft., where formerly about 6 to 20 ft. was used.

The finished bins of the Portland Flouring Co. They measure 16 ft. in diameter, 67 ft. in height, with wall thickness of 6 in. Transit mixer trucks did the job in 122-3/4 hours total pouring time

Transit mixers furnished the concrete for eighteen grain bins built by the MacDonald Engineering Co., of California, for the Portland Flouring Mills, Portland, Ore.

The truck with its charge of measured dry ingredients of from 1 to 3 cu. yd. of concrete travels to the point of delivery, mixing the dry ingredients well by an arrangement of vanes fastened at various intervals in the sides of the drum, which cut and mix the aggregates as the drum revolves. About four minutes before reaching the job, the driver puts the mixer into gear and mixing operations start, and at the same



Two views, taken during April, 1930, of construction work on the $11,000,000 St. John's Bridge, Portland, Ore., for which about 60,000 yds. of transit mixed concrete was furnished from a temporary charging plant

time the pre-measured water is turned into the mixer by a valve in reach of the driver's seat, from the tank in the top of the truck frame. The aggregates are then thoroughly mixed so that upon arrival at the job the concrete may be poured immediately. The mixer will rotate either way so that all of the concrete is easily dispelled with no segregation. En route back to the plant the driver turns in a supply of water and starts the mixer revolving, thus cleaning the drum thoroughly for the next batch of aggregates. Especially built scales at the plant weigh the sand, gravel or crushed stone and cement so that the exact proportions may be had.

While the entire system has been patented, Mr. Yett has worked out many improvements on mixers. In June the Boston Transit Mixers, Inc., Boston, Mass., started operations with a plant which is an exact duplicate of Swigert, Hart and Yett Co.'s plant in Portland, Ore., and are now erecting a second plant built entirely of concrete, which also incorporates all of the Yett patented plant devices.

The main charging plant, as well as the offices of the company are located on the Willamette river, adjacent to the sand and gravel bunkers of Swigert, Hart and Yett Co. Material storage is provided by five bins holding aggregates as follows: One bin containing 35 yd. of 3 in. gravel, 1 bin containing 35 yd. of 1 in. gravel, 1 sand bin containing 35 yd. and 1 containing 18 yd. The hopper for the cement has a capacity of 300 tons of bulk cement.

After the materials are in the storage bins, they are handled entirely by gravity with the gravel acting as a conveyor for the sand and cement as they are poured into the mixing truck. All of the materials are accurately proportioned according to the mix desired by the specially designed scales.

Up to the present date Swigert, Hart and Yett Co. has furnished 80,000 cu. yd. of "Perfect Mix" concrete on different building jobs in the city of Portland, and approximately 100,000 cu. yd. of concrete pavement for the city of Portland has been laid.

American Refractories Institute Elects New Officers

THE American Refractories Institute, Pittsburgh, Penn., at its annual meeting at White Sulphur Springs, W. Va., May 19, elected the following officers for the ensuing year: President, W. J. Westphalen (vice-president, Laclede-Christy Clay Products Co., St. Louis, Mo.; first vice-president, W. B. Coullie (general sales manager, Harbison-Walker Refractories Co., Pittsburgh, Penn.); second vice-president, P. S. Kier (vice-president, Kier Fire Brick Co., Pittsburgh, Penn.); treasurer, C. C. Edmunds (vice-president, McLain Fire Brick Co., Pittsburgh, Penn.); secretary, Dorothy Texter 2218 Oliver building, Pittsburgh, Penn.; directors, 1930-33 term: J. M. McKinley, vice-president, North American Refractories Co., Cleveland, Ohio; W. B. Coullie, general sales manager, Harbison-Walker Refractories Co., Pittsburgh, Penn.; C. C. Edmunds, vice-president, McLain Fire Brick Co., Pittsburgh, Penn.; Roger A. Hitchins, secretary, General Refractories Co., Philadelphia, Penn.; W. H. Peterson, vice-president, M. D. Valentine and Bro. Co., Woodbridge, N. J.; Chas. S. Reed, president, Chicago Retort and Fire Brick Co., Chicago, Ill.; R. M. Sievers, district sales manager, Harbison-Walker Refractories Co., St. Louis, Mo.; W. J. Westphalen, vice-president, Laclede-Christy Clay Products Co., St. Louis, Mo.

Transit-Mixed Concrete Makers Form National Association

THE operators of Paris transit mixer concrete manufacturing equipment in the United States met at Chicago, April 15-16, 1930, and formed their own National Association, the first of its kind, adopting the name, "Association of Paris Transit Mixed Concrete Manufacturers."

The officers elected to head the national association were: Porter W. Yett, of Swigert, Hart and Yett, Inc., Portland, Ore., president; Charles P. Maloney, Maloney Paving Co., Washington, D. C., secretary; and Bruner R. Penniman, Penniman Gravel and Materials Co., Dallas, Tex., treasurer.

Mr. Yett, the newly elected president, when interviewed, was optimistic as to the future of the transit mixed concrete industry and enthusiastic in his predictions regarding the future of the association. In outlining the need which created the national organization and its plans, he said:—

"The necessity of forming this association has been brought about by the rapid advancement in the art of manufacturing concrete, which has caused an almost unprecedented demand by the public for highways and buildings of concrete.

"Due to this universal demand for concrete products in the United States and the similarity of design and specifications by architects and engineers, it became apparent that the manufacturers of concrete products must immediately take steps to furnish a uniform and high grade product, irrespective of the territory in which they might be producing.

"The advancement of the art of manufacturing concrete has developed to a point where it is now possible for engineers and constructors to design a concrete structure with a factor of safety that is within economical bounds. This is apparent by the statements of some forty operators of transit mixing manufacturing plants that they can, and will, definitely assure the designing engineer of 85% uniformity in their product in relation to consistency, strength and workability. This is a remarkable tribute to the many schools, architects and engineers who have worked so diligently for years, trying to solve the problems of concrete construction, for, as we all know, it has only been a few short years back that any constructor or engineer would allow more than 25% efficiency in the designing of concrete structures. This very low efficiency rating seems to have been caused principally by the inability of the manufacturer to eliminate the human element, and in some cases by the irresponsible contractor.

"The formation of this national organiza-

tion of manufacturers of concrete products is another step in the assurance to the concrete consuming public that the production of concrete is rapidly passing into the hands of responsible people with whom the consumer may deal with confidence and on whose product he may absolutely rely.

"The national association, whose membership comprises only substantial and responsible operators, highly appreciate this confidence. As a pledge of their good faith, and to further protect the consumer from any

Porter W. Yett, elected president of the newly organized transit mix association

inferiority in product caused by excessive or irresponsible competition, this national association of concrete manufacturers authorized the adoption of a code of ethics. This code will provide a definite policy, maintaining quality and uniformity of product wherever manufactured and controlling the relations of each member in his dealings with the consumer. Adoption of such a policy will assure the engineer and constructor of a product absolutely up to specifications, backed not alone by the guarantee of the individual operator furnishing it, but also by the powerful national organization of which he is a member and its local representative. Every industry is founded on the confidence of those it serves, and the aim of our national association will be to have the complete confidence of every engineer, constructor and user of concrete in the United States, and universal recognition of the trade name adopted by this association for its product as the mark of quality concrete.

"That the manufacture of transit mixed concrete is a fast moving business has been demonstrated by its marvelous development in the last two or three years, and as yet the industry is in its infancy. Looking into the future, the founders of our national association have planned an active program for the advancement and development of ideas and designs of concrete. This will be worked out through experiment and expert technical advice from laboratories developed by the national association itself and by cooperation with the research departments of various colleges and departments of the government, giving them an opportunity to conduct useful experiments based on actual practice in the manufacture of concrete as used by members of the association. Machinery, equipment and methods used throughout the United States in the manufacture of transit mixed concrete will be studied and valuable assistance given its operators by an association advisory service keeping them in constant contact with the latest developments in equipment and methods. Each purchaser of transit mixed concrete from a member of the national association may be assured that he is getting the highest grade product possible, manufactured and delivered in the most efficient way, based on the combined experience, research, tests, and ideas of the entire industry throughout the United States.

"Each separate phase of the organization, research and development work of the national association has been placed in the hands of the particular member of our association who is an expert in that field. An executive secretary has been employed to handle association matters, and we are moving ahead with our program.

"I feel that our national association is particularly adapted to fill a great need in the field of concrete manufacture, and one which can be filled in no other way. The carrying out of our policies will result in giving users of concrete throughout the country an absolutely uniform, scientifically manufactured product of the highest efficiency. The consumer of our concrete may be assured that he is constantly receiving the co-operation and assistance of an alert and aggressive national organization, vitally interested in the development of his business and of their product, methods and service to him."

Porter W. Yett is general manager of Swigert, Hart and Yett, Inc., Portland, Ore. This company is the only Portland concern delivering concrete mixed in transit. Mr. Yett is also regional vice-president of the National Crushed Stone Association.

In 1910, Porter W. Yett started operating in Portland. He organized the City Motor Trucking Co., a trucking concern which was one of the first in the United States to use motor trucks for hauling paving material. In a short time he expanded and began operation of a rock quarry and a paving contracting business in connection with his motor trucking company.

For ten years, Mr. Yett was interested in paving and contracting which gave him considerable experience in the operation of asphaltic paving plants. During this same period he had charge of the delivery of stone and other materials used in the construction of Oregon's famous Columbia River Highway.

In 1925, he began an investigation of the pre-mixed concrete business and in 1928 erected the first weighing and proportioning plant, used in connection with Paris transit concrete mixers, in the United States. That

Bruner R. Penniman, Dallas, was made secretary

same year, his proportioning plant and Paris concrete mixers combined delivered over 100,000 cu. yd. of paving concrete in the city of Portland. This was the first successful transit mixed concrete pavement laid in the United States.

Last year, 1929, Mr. Yett erected another special proportioning plant of his own design which was to be used for the sole purpose of delivering 75,000 cu. yd. of concrete, by means of transit mixers, for construction of the St. Johns suspension bridge at Portland.

Mr. Yett is rather an unusual young man, typical of the national industry which he heads. It is interesting to note that a poll of all Paris transit mixed concrete manufacturers taken at the Chicago meeting showed their average age to be 42 years. Although considerably under this age, Mr. Yett has been identified for years with the social and civic life of his home city, Port-

land, Ore. In 1910 he was amateur featherweight boxing champion of the Northwest and he is also a prominent newspaper sports writer. For the past twenty years he has been active in baseball and is at the present time president of the Portland City Baseball League.

Mr. Yett's record of achievement and the remarkable development of his own business indicate beyond question that the new national organization will be successful, and a dynamic force in the manufacture of concrete products in the United States.

Albany Gravel Co. Has New Hydraulic Operation

SEVERAL MONTHS AGO, G. K. Smith, head of the Albany Gravel Co., Albany, N. Y., went to Croton and negotiated with the contracting firm of Ottaviano and Morton, owners of VanWyck Gardens, Croton's 32-apartment building, and the 60-acre residential park adjoining, to purchase the right of mining sand and gravel from the former property of the Baroness deGraffenreid, bordering on Albany Post road. Recently the Alabama Gravel Co. purchased the right to operate the other half of the property owned by the baroness, which had recently been purchased by Ottaviano and Morton, thus enlarging the scope of the Albany utility.

It is estimated that there are over 3,000,000 cu. yd. of sand of marketable value in the two sections of the property. Before obtaining the right from Ottaviano and Morton, the Albany Gravel Co. had the different stratas of sand undergo an analytical test by the United States laboratories in Washington and were fully satisfied that all expectations had been justified—the sand and gravel bore all attributes of requirements for commercial purposes. All showed A-1 qualities for concrete or other purposes.—*Ossining* (N. Y.) *Register.*

Large California Blast Moves 330,000 Tons of Granite

OVER 330,000 tons of granite were dislodged by a recent blast at Jackson, Calif., to secure rock for a dam under construction on the Mokelumne river. The dam, projected by the Pacific Gas and Electric Co., will be, it is claimed, the largest rock felled structure in the world, rising to a height of 360 ft., 1320 ft. in crest and 960 ft. thick at the base.

Over 84,500 lb. of explosive were used to dislodge the rock. This was placed along the solid quarry face which in preparation for receiving the explosives was hauled for 750 ft. of its length to depths of about 150 ft., and back about 45 ft. The accompanying views show a section of the quarry face before the blast; the face beginning to collapse just after the blast set-off and the third view shows the rock as broken down by the blast.

Quarry face before the blast

The blast showing the face about to collapse

Face immediately after the blast (all photos by International News Photos, Inc.)

Diesel Engines for Air Compressors

Numerous Applications Demonstrate Economy and Particular Adaptability of This Prime Mover

By Orville Adams
Dallas, Tex.

COMPRESSED AIR is essential to many basic operations in the rock products industries. Hence the work of compressing air requires consideration of primary power from the standpoint of reliability, flexibility and economy. Moreover, certain mechanical considerations are involved. The widespread use of the Diesel engine for driving air compression units in all the rock products industries indicates an appreciation of this prime mover to a very great extent. It has been found to be adaptable to portable, semi-portable and stationary uses in every operation where compressed air has been needed, and can be used under conditions that make the application of any other power practically out of the question. In remote mining operations, plants far from any primary source of electric power, and in localities where water is difficult to obtain, the Diesel engine has been found producing power at a price that compares very favorably with that available in the most favored electric power rate zones.

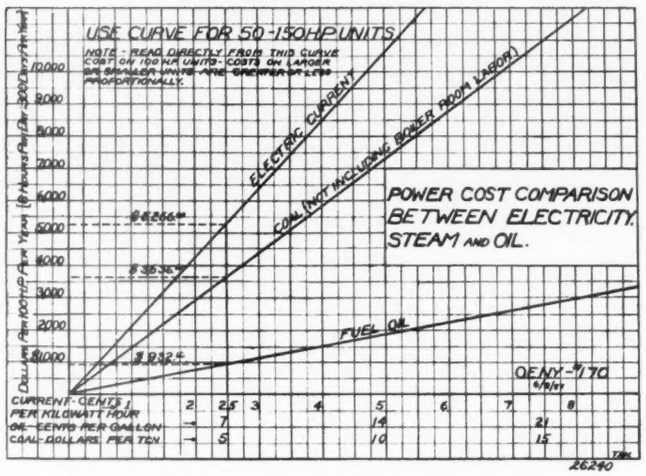


Table 1. Power is essential item in connection with the operation of air compressors. This chart shows the ratio of power production costs

Early Applications

The first important application of the Diesel engine to air-compressor drives consisted of large units, with the engine direct-connected to angle or similar type machines, either horizontal or vertical. A standard Diesel drive for air compressors is, however, a development that has taken place in a comparatively few years. The early success and economy realized led to the development in recent years of Diesel and oil engines and compressors for this kind of work, as a complete unit, either built integral as the old type steam-driven machines, or direct-connected through suitable couplings.

Contribution of Compressor Manufacturers

Some of the leading air compressor manufacturers, who also build Diesel engines, were the first to realize the great possibilities of the combination of the Diesel and air compressor, and have built these units for some years, meanwhile making rapid progress in satisfactory design and application in many sizes, speeds and capacities. An example of the horizontal engine-compressor unit built as one machine with common crankshaft, flywheel and base is the Ingersoll-Rand type POC unit, shown in Fig. 1.

The completeness of this type of layout is illustrated in Fig. 2, with all necessary auxiliaries and apparatus for independent operation, indicating the simplicity of a Diesel-air-compressor plant. A surprisingly small amount of attention is required, the space is economically utilized, such machines having been installed deep in tunnels, mine shafts, etc.

Operating Experience

A wealth of data on cost of power has been accumulated from world-wide experience in operating under all kinds of condi-

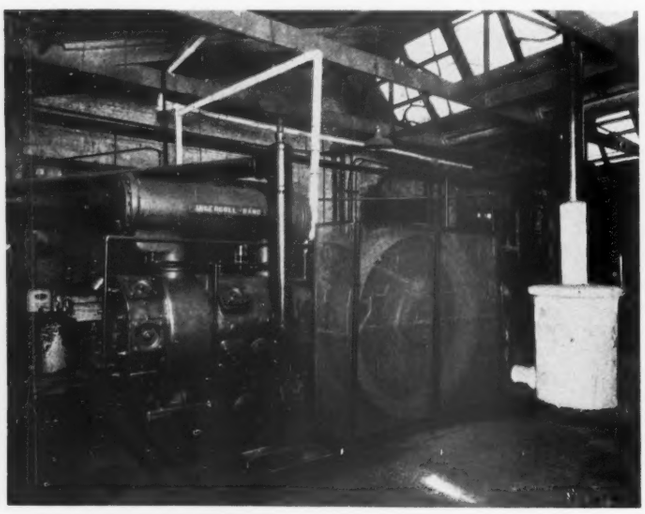


Fig. 1. Horizontal engine-compressor unit built as one machine with common crank shaft, flywheel and base

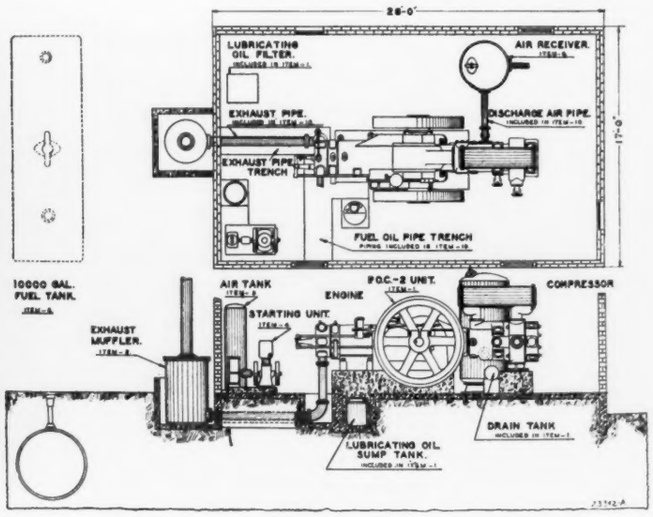


Fig. 2. Showing completeness of type of layout shown in Fig. 1 as well as indicating simplicity and economic use of space

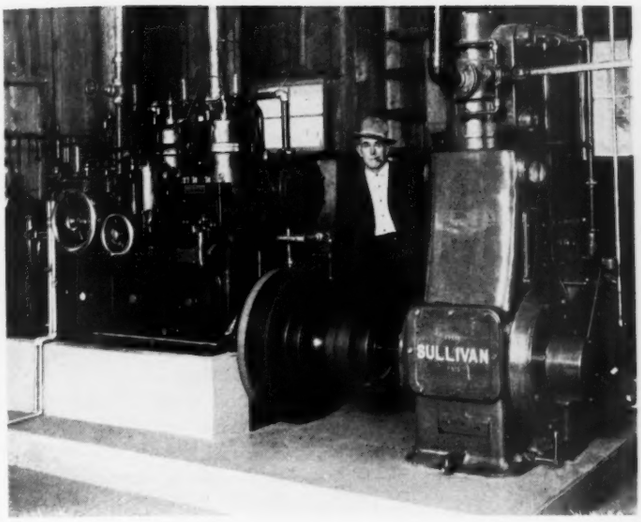


Fig. 3. High speed marine type engine

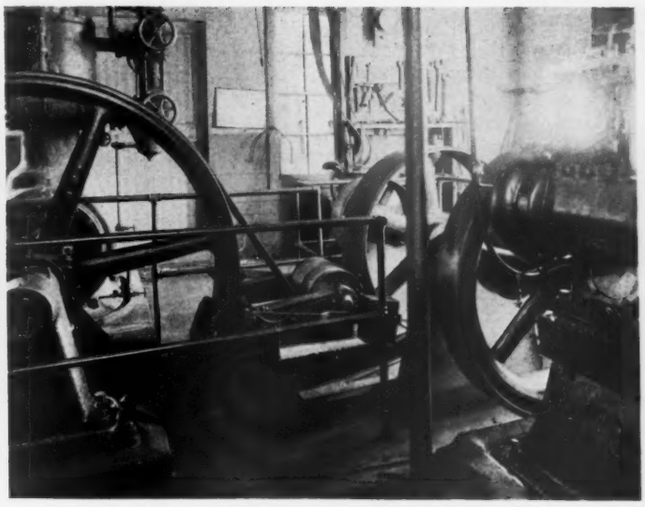


Fig. 5. A popular drive for oil engines

tions, so that comparison can be made with other kinds of prime movers, and we know therefore that the relative cost of oil engine power compared with steam and electricity makes economy an outstanding factor. An examination of the curves in Table 1 will reveal an astounding ratio of cost, this cost ratio being electricity 5, steam-driven units 4 and oil engines 1. In other words this curve shows that it cost more than 5 times as much to run a 100-hp. electric motor than it does to run an oil engine of the same size. It also shows that it cost four times as much to run a steam engine.

The primary reason for the Diesel engine is its efficient use of the fuel. It is easy to figure the economy of this prime mover compared, for instance, to steam. One horsepower is equivalent to 2545 B.t.u. Therefore, if there are 18,500 B.t.u. in a pound of oil, a theoretically perfect oil engine would consume only 2545 divided by 18,500, or 0.14 lb. of oil per brake horsepower. There are to be deducted from this the following losses:

1. Heat carried away by water jacketing. This loss is approximately 30%.

2. Heat in the exhaust gases. As it is not practical to expand fuel-oil gases down to atmosphere, the exhaust is at high pressure with a temperature of approximately 600 deg. F. This is another loss of 30%.

3. The mechanical efficiency of the engine is about 85%. When these total losses are taken into consideration, the oil engine actually consumes about 0.43 lb. of fuel oil per b. hp. or 7955 B.t.u. (0.43x18,500).

In the curves, Table 1, taking into consideration fuel and lubricating oil required to run a 55-hp. engine, it cost only $2 a day for 8 hours, or 24 cents per hour. This remarkable economy obtains throughout the entire application of oil engines in air-compressor service.

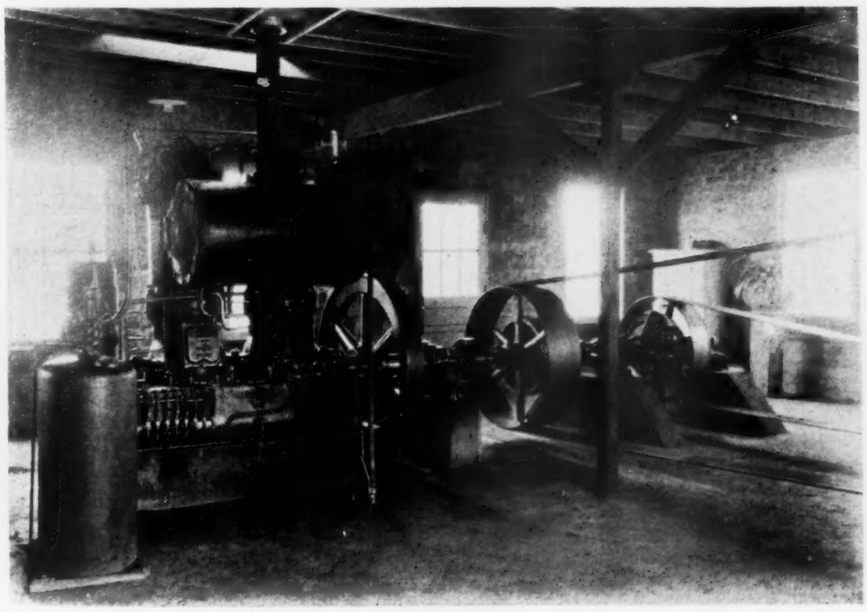


Fig. 4. 120-hp. oil engine driving a two-stage air compressor

Similar types of machines built by the Chicago Pneumatic Tool Co., which also comprise vertical units with the oil-engine direct connected, have been widely used in this field. It should be noted that the application of four-cycle, solid injection engines of one and two or more cylinders has been perfected, and has not proven very difficult even with moderate sized flywheels.

Important mechanical comparisons of engine durability are afforded by this experience. The engine end of the units apparently gives no more trouble, nor requires more repair and maintenance cost than the compressor end; and it has been found that the oil engine, when operated properly, is subject to little more mechanical difficulty than any other reciprocating machine. Careful surveys of maintenance cost, repairs, such as cylinder reboring, rings and lubrication have been made for these units. It is one service where the oil engine has demonstrated in more ways than one its ability to carry on with the same degree of satisfaction as the other machine.

Types of Engines Used

There are many different practical applications of oil engines for driving air compressors. In nearly all cases, air compressors lend themselves to some kind of oil engine drive regardless of the service, speed, power required, or operating conditions.

Frequently higher speed machines are encountered where engines to be direct connected must operate at similar speeds. The marine type engine can be used. Such an installation is shown in Fig. 3. This 75-hp. Fairbanks-Morse engine operates at 400 r.p.m. and drives a Sullivan 12x7½x8-in. angle compound compressor. Considerably increased capacity is realized by operating at this speed. Higher speed engines have gained favor throughout the industry and operations of many different kinds demonstrate a very satisfactory performance.

The most important field for the high-

speed engines is in replacing service formerly employing the gasoline engine, for these high-speed portable types fit into the same applications with little or no particular modification. It is frequently desirable to replace such equipment, and the Diesel engines now being built find a place in this service more frequently than it is generally realized.

These engines are built similar to, and operate very much like, the conventional type of heavy duty gasoline engine, with the fuel injection valve replacing the spark plugs as a primary difference. However, such engines are usually designed with much greater appreciation of the severe operating temperatures, long life and upkeep cost.

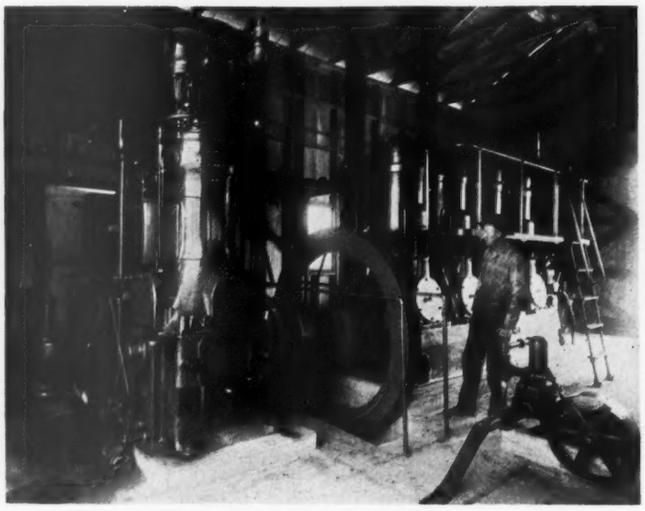


Fig. 6. A 240-hp. engine driving air compressor in Elberton Quarries Co. plant, Carlton, Ga.

Typical Drive Methods

As many drives may be worked out as conditions and types of engines require. They range all the way from a belt-driven layout to a built-in unit. Fig. 3 shows a Bolinders oil engine driving a two-stage compressor through a friction clutch arrangement, with an extension shaft and additional friction clutch which also controls the drive for a centrifugal pump, both driven units deriving the power from the same oil engine. Many such combinations are found in the rock products industries, where it may be desirable to drive pumps as well as compressors, and even the entire plant from a single unit.

Short centers, where space is not available for long belt drives of the usual design, may be worked out. The "Lenix" drive, "Texrope," "Tentacular," "Silent" chain and others have been used for direct connecting Diesel engines to air compressors. In Fig. 5 a Lenix drive is used to give any ratio of speed required, employing an efficient idler principle that takes care of belt tension, belt stretch and variations in belt widths available, and is a popular drive for oil engines.

Granite Quarry Applications

An unusual volume of compressed air is frequently required in granite quarries. In Fig. 6 is shown a 240-hp. engine driving a Sullivan compressor at the Elberton Quarries Co. plant, Carlton, Ga., which operates on a 40% load with an average daily fuel consumption of 120 gal. of oil per 10-hr. day, with fuel oil at 7.125 c. per gal., and lubricating oil at 45 c. for 1½ gal. per day; the cost of operation is $9.40. This machine is used for operating quarry bar drills, tripod drills, plug drills and rotators, also a "steam" hammer and drill sharpener in the shop, together with forges used for blacksmithing and air hoists.

Tunneling and Underground Mining

Tunneling and underground mining operations require compressed air as a major power supply and a great number of Diesel engines are used. A Diesel is not an expensive installation, comparatively speaking, and there is no big loss in temporary installations as with boiler construction for steam power plants.

A practical demonstration of the application of oil engines in rock excavation and tunnel work was carried out by the Walsh Construction Co. on an operation between Garrison and Break-Neck tunnel and at Cold-Spring-on-Hudson, N. Y., where the right-of-way of the New York Central railroad was widened. In Fig. 7 is shown four Ingersoll-Rand units on this work. This plant was erected and in operation before the building housing it was put up. This first installation at Garrison consisted of 110-bu. POC units, single-cylinder, horizontal, four-cycle engines, tandem attached to two-stage, differential piston compressors, each with a capacity of 625 cu. ft., giving the plant a capacity of 2500 cu. ft. per minute.

The plant supplied air for the "Jackhamers," I.-R. drifters, drill sharpeners, blacksmith shop and oil-fired forges. Another similar engine was installed two miles above this plant at Cold Springs. Two additional units were installed two miles farther up the line at Break-Neck tunnel, making seven units used on this job.

One of the particular advantages on this kind of work is when it is necessary to move the engine to another location, all that is necessary is to make the foundation, level off the space required for the engine room, have water and air lines laid, then move the engines and compressors bodily, set them on the new foundations, grouting them in, requiring but a few days. A quick-hardening cement is often employed for these rapid moves.

Advantages of Oil Engine Drive

There are many advantages claimed for the oil engine drive for operating the air compressors. We have already given attention to the fuel and oil cost. Over-all economy of operation is proven by reports from all quarters, and there is practically no ques-

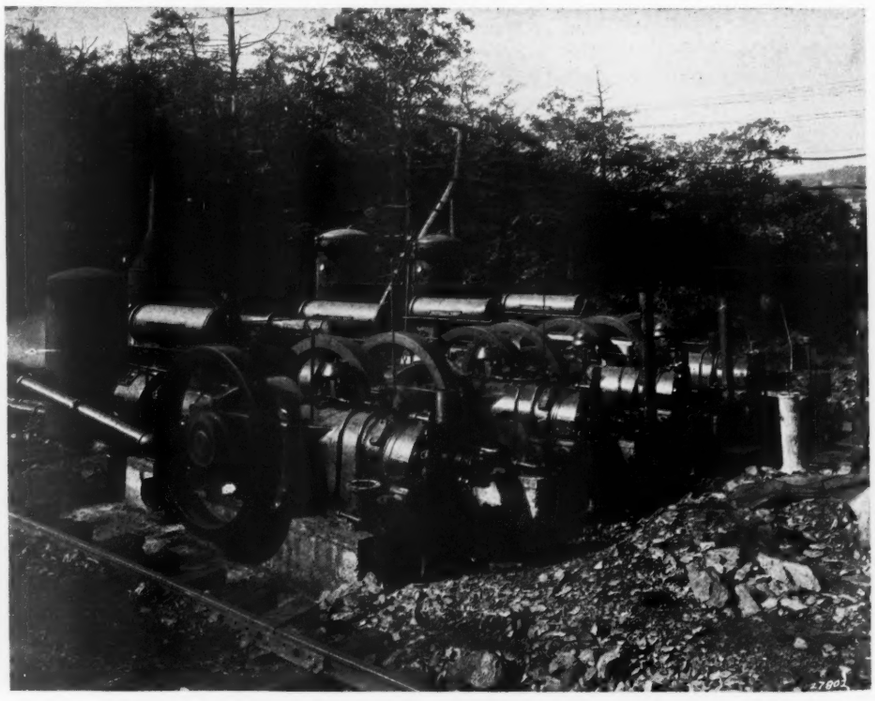


Fig. 7. Four oil engine units in rock excavation and tunnel work on railroad right-of-way operation

tion about it being the lowest for general purposes. On the other hand such installations have a very low first cost when compared to other forms of power, particularly under conditions where the installation of electric drive or steam power is difficult, and the nature of the work so temporary that the investment in transmission lines would not be absorbed on one job.

It has been found on jobs which have used electric power that the investment in the power line would have paid for the engine on that particular job, and in many others this has been the deciding factor in favor of the oil engines. Adaptability and mobility are therefore a primary consideration when installing power for construction work, mining locations and even stationary plants far from primary sources of power.

While no oil engine driven air compressor plant is so automatic as to operate without an attendant, a full time operator is by no means necessary to look after these outfits. In most cases no extra labor or attendant is ever employed, the necessary attention to such plants given by men required for other work in connection with the operation of such plants. In fact there is little or no difference so far as this item is concerned whether the compressor plant is electric or oil engine driven.

On the other hand, no banked fires, or coal burned when the plant is inoperative is required and standby losses are reduced to a minimum, and there is no "connected load" charge to increase the power bill. These modern oil engine plants may be started up cold, and be carrying full load in a few minutes. And there is no "maximum demand" charge to contend with, even if the plant is operated at partial of full load at any time of the day or night. Load factors make little difference to a Diesel engine so far as over-all cost is concerned.

There are available combination outfits for portable air compressors to take the place of expensive gasoline operation. It may be expected that many of these units will make their appearance on the streets, in the quarries and for road work in the coming years. Such engines should prove no more difficult to operate than the power plants now being used, and will certainly give better economy and have longer life.

Proceedings of the American Road Builders Association

THE PROCEEDINGS of the twenty-seventh annual convention of the American Road Builders Association held at Atlantic City in January of this year have been published and are available at $5 per copy by addressing the association in the National Press Building, Washington, D. C. The 851-page book also includes a list of the exhibitors at the Twenty-first Annual Road Show. The proceedings were edited by Charles M. Upham, assisted by Louise Wynne.

Superior (Ohio) Cement Plant Opens Season with Enlarged Capacity

THE Superior cement plant in Lawrence county, Ohio, resumed production in April with a full force of 200 men. The Jackson, Ohio, office of the cement business under the name of the Wellston Iron Furnace Co. is now a busy place as is the factory on the D. T. and I. in Lawrence county. The return of seasonal demand for cement is being reflected in the home office and the outlook for a steady run was never better.

Since the plant shut down last November a new kiln has been added increasing the capacity of the plant from 2400 bbl. daily to 3200 bbl. or an increase in production of 33⅓% in capacity. This indicates the confidence the management has in the future of the cement industry. Not only has the capacity been increased but the quality has also been strengthened. That in fact has been the ideal for the past two or three years. When the rebuilt factory was placed in commission the problem then was to discover means of making the cement as good as it is possible to turn out. With this in mind a force of engineers and chemists have been kept constantly busy experimenting and testing the cement, comparing it with every other brand made. They have sought the most exacting tests by government, state and city engineers as well as those employed by private operating companies. In this they have never failed to stand in the front ranks.

Asked recently about the business outlook as it is reflected in the nation at large, S. E. Stephenson, president of the company, replied: "The outlook is growing better every day. The widespread construction policy inaugurated by the President is having its effect and business is gradually reviving under its stimulating influence. There will be more public improvement of every sort this year than ever before in the history of the nation and private enterprise is with due caution and safety taking on larger activities.

"Everything indicates that stocks have reached the lowest prices and commodities of all sorts are now at the lowest. Whatever change there is hereafter will be on an upward grade, if the business barometers of the nation can be trusted."

Health of Men Safeguarded

With the resumption of activities President Stephenson also made an announcement of much importance to the men and the community. Dr. W. R. Riddell has been employed by the company to make weekly visits to the factory and treat the men. Each man will be required to take a physical examination and those needing medical or surgical attention will be given proper treatment. Dr. Riddell will go to the plant each Friday morning and every man needing his service will receive attention without cost to the man. The company has purchased an old Catholic church and it will be remodeled into a temporary hospital where men can be given first-aid and consult the doctor whenever he is needed. This is done entirely at the expense of the company and it is a service to build up a better physical condition among the workmen and put more stamina in the morale of the employes.

This system has been in effect at the Crown Pipe and Foundry Co. under the direction of Mr. Stephenson as receiver and its results have been so very satisfactory that he has extended it to the Superior plant. Dr. Riddell has been the medical advisor at the Crown plant for two years and in that time there have been but two cases of absence from work on account of illness that was other than temporary. It is practiced by a large number of institutions where a large number of men are employed and has been found to be a wise method of handling health conditions.—*Jackson* (Ohio) *Herald.*

Bailey and Stewart Plant Adds New Machinery

THE GEORGIA QUINCEY GRANITE CO., plant, Sparta, Ga., which was reopened by Messrs. Bailey and Stewart, several months ago, is now running full time and the promoters state, "that they have business enough to keep them going for some time." The new owners of the quarry have put in new machinery which enables them to get out several carloads of crushed stone daily and they hope to increase this materially during the summer months. They have installed a "tram road" for hauling the stone to the crusher which makes this part of the work faster than the old method of using mule teams.

The new concern is also cutting curbing, monumental and building stone and expects to enlarge this portion of the business also. With almost an unlimited amount of stone in easy reach of the crusher, it is thought the company will be able to operate for many months, if they can sell the output. With much road paving to be done in the state this year, it is probable that the demand will be good.—*Sparta* (Ga.) *Ishmaelite.*

Erratum

IN ROCK PRODUCTS, May 24, p. 74, in the report of the Milwaukee meeting of the National Sand and Gravel Association directors, J. R. Thoenen, mining engineer, U. S. Bureau of Mines, was quoted as saying that the Bureau of Mines would assist sand and gravel operators in making returns to the U. S. Bureau of the Census. This is incorrect, as the Bureau of Mines is entirely independent of the Bureau of the Census. What Mr. Thoenen did say was that he had assisted in getting up the census questionnaire and might help the Bureau of the Census in interpreting it, if called upon to do so.

New Machinery and Equipment

Light Control Device

THE PHOTO-ELECTRIC RELAY recently developed and placed on the market by the General Electric Co., Schenectady, N. Y., so far as we know, has not yet found an application in the rock products industry, although it has many hundred other possible applications and doubtless an application will be found for it in this industry.

Many industrial or other operations in which a change of light is involved can be controlled by the new relay. In addition, many operations which can be arranged to cause a change of light can be so controlled. A machine, for example, which travels in a certain direction for a certain distance and is then stopped or reversed, is a typical application. When the traveling mechanism reaches its limit it would interrupt a beam of light falling on the photo-electric tube and thus cause the control device to function.

Another example of application would be in counting items such as bags of material, or boxes, where mass production is involved. As each item passed through the essential beam of light it would cause the photo-electric relay to operate and actuate a magnetic counter. Vehicles passing a definite point can be counted in like manner. An example of this application is found in the Holland Tunnel, where automobiles are counted by the photo-electric relay.

A third type of application would be sorting packages according to size, shape or reflecting power. Other examples would be stopping a paper machine when the paper breaks, aligning the paper on the rolls of the same machine, turning electric signs or signals on or off, depending on the intensity of the outside light, deflecting packages on conveyors, and operating bag-piling mechanisms.

The use of the photo-electric relay to control lights or illuminated signs according to the intensity of daylight is an interesting one. In an office or factory building it is always desirable to have a certain minimum light for the workers. During the daytime, when the daylight intensity is high, no artificial lighting is needed. By using the new relay, the artificial lights can be turned on automatically when the daylight intensity falls below the predetermined minimum.

The new relay bears the General Electric designation CR-7505-A-1. It is designed for use in controlling an electric circuit in response to an increase or decrease in the amount of light falling on the photo-electric tube.

For some applications it may be necessary to select carefully a suitable light source and optical accessories, but for many cases the light source may be a domestic Mazda lamp with or without a simple reflector and shield.

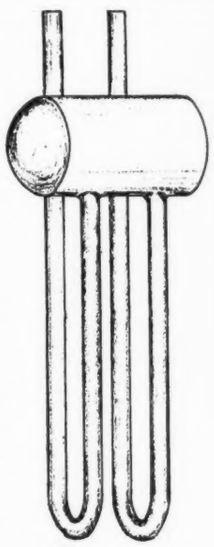
The standard electric supply for the relay is 110/120 volts, 60 cycles, alternating current. The device may, however, be built on demand for other frequencies or voltages, and a similar device for operation where only direct current is available can be obtained.

The operation of the relay is described technically as follows: With a voltage of proper polarity and magnitude applied between the two elements of the photo-electric tube, the current it passes is proportional to the amount of light shining on it. This current (of the order of a few micro-amperes) is amplified by a pliotron. The sensitive relay is connected in the plate circuit and is energized or de-energized in accordance with the amount of light on the photo-electric tube. The contacts of the relay control the coil circuit of the contactor. When the relay in the plate circuit of the amplifier is energized it will first open its normally-closed contacts and then close the normally open contacts. This relay, therefore, either makes or breaks the coil circuits of the contactor, depending on how it is connected.

When the contactor is de-energized approximately 10 watts is required by the device, and when the contactor is energized approximately 30 watts is required.

Well Type Manometer for Combustion Mixtures

A NOVEL TYPE of flow meter for the purpose of measuring the mixture of liquid or gaseous fuel used in furnaces, such as lime or cement kilns, has recently been announced by the Meriam Co., Cleveland, Ohio.

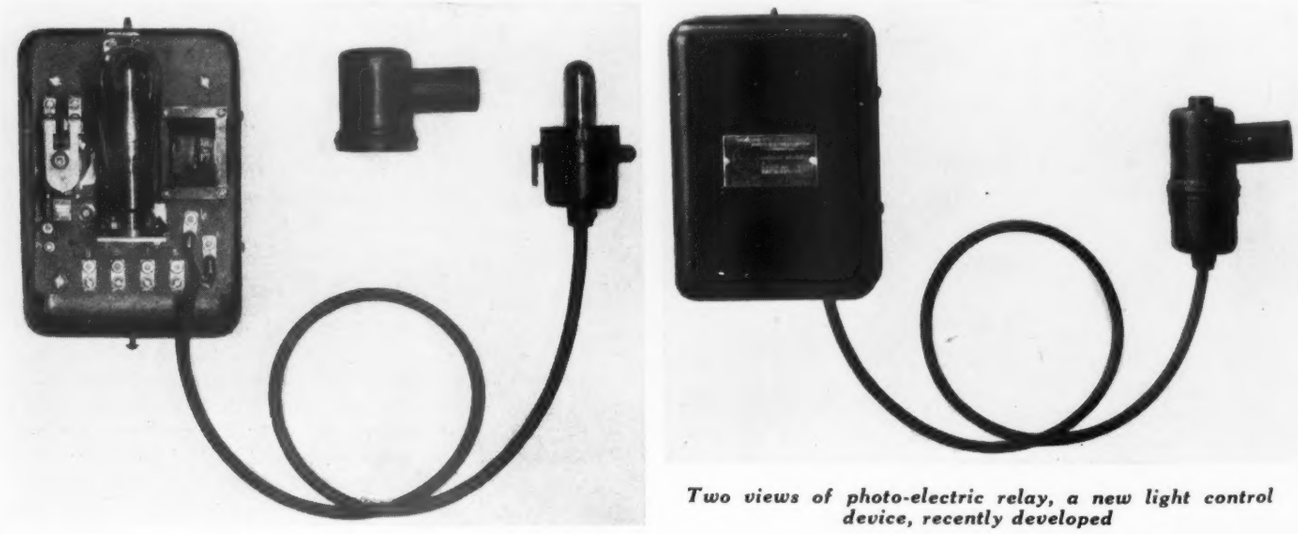


Manometer

The new instrument, which is mainly used in the metal-working industries, is made up of a series of compact manometer units.

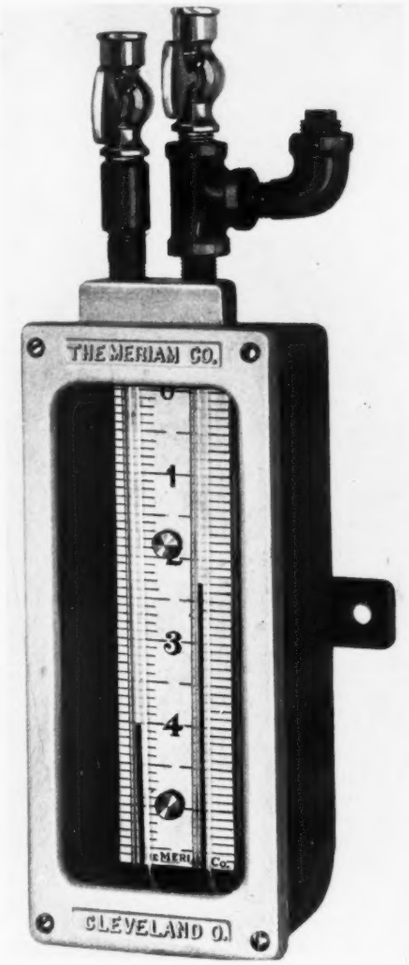
Principles of operation are shown in the accompanying diagram.

The two U-tubes are connected to a single reservoir or "well," which is large in volume compared with the U-tubes, although small in actual cubical con-



Two views of photo-electric relay, a new light control device, recently developed

tent. The well is partly filled with suitable liquid, and the free ends of the U-tubes are connected to pipes tapped off the supply lines of air and gas respectively. It is evident that although both U-tubes are connected to the same well, their liquid levels will vary independently according to the



Novel type of flow meter

pressure of the fluid in the supply lines. Units may be assembled compactly in any desired number, and operation is independent of the distance from supply line flow to be measured.

Strictly speaking, the instrument indicates pressure only. However, it can be made to read quantity of flow directly by inserting in each supply line a suitable orifice disc of known dimensions and having the manometer unit calibrated accordingly.

New Size Automatic Weigher

SCHAFFER POIDOMETER CO., of Pittsburgh, Penn., has added to its line of poidometers a smaller size with belt width of 6 in., which is designated as the No. 6 poidometer. The new size is substantially the same in construction as the larger sizes and, the manufacturers state, provides the same automatic operation and accuracy characteristics of the larger poidometers. Capacity of the No. 6 is 1 lb. to 100 lb. per minute on finely ground materials.

Steam Locomotive of Rugged Construction

THE Heisler Locomotive Works of Erie, Penn., is marketing a new steam locomotive that is said to have 30 to 50% more power than the ordinary locomotive of the same weight.

The manufacturers state that the Heisler engine piston delivers 2 to 2½ times as many power impulses per revolution of the drivers compared to the ordinary locomotive of similar weight, giving a much higher starting torque that is uniformly applied, for the power thus developed is transmitted to all the wheels, each wheel being a driver.

The locomotive is manufactured in all sizes up to 110 tons in weight and with a wide variety of models to choose from so that an engine can be supplied for most any haulage condition.

The high mechanical success of the Heisler steam locomotive is said to be due to several features, among which might be mentioned the equal distribution of weight on each wheel or driver so that the full power of the locomotive engine is put to work. According to the manufacturers, this feature and that of a low center of gravity give ideal stability.

The Heisler locomotive has a V-type engine on the center line—supplied by the main frame and entirely independent of the boiler. One cylinder is on each side of the locomotive and the connecting rods drive the central shaft direct. This central shaft is geared to one driving axle on each truck through a bevel gear and pinion, thus making every wheel a driver.

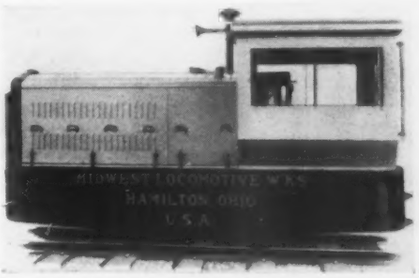
The centralized position of the drive shaft, with the boiler centered, also equalizes the load on the different parts of the main frame and gives an equal distribution of strains.

Gasoline Locomotives Equipped with Roller Bearing Journals

THE Midwest Locomotive Works, Hamilton, Ohio, has recently put out a new line of gasoline locomotives, a special feature of which is journals equipped with Timken roller bearings.

The weight of the body and frame is carried by semi-elliptical springs which are equalized to cushion the shocks to the journal bearings ordinarily experienced in rough quarry and gravel pit work.

Two makes of engines are used to power the locomotive, those up to and including 12 tons being equipped with Hercules gasoline engines, and the 16-, 20- and 25-ton locomotives powered with Climax gasoline engines.



Gasoline-engine locomotive with roller bearing journals

32-ton, 48-in. gauge locomotive handling four loaded 10-yd. dump cars

55-ton locomotive handling train of four 30-yd. dump cars

The Rock Products Market

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, Farmingdale, Spring Lake and Wayside, N. J.	.48	.48	1.15	1.25	1.40	.....
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.25	1.15	1.75	.....	1.75	1.75
Buffalo, N. Y.	1.00	1.05	1.05	1.05	1.05	1.05
Erie, Penn.	.70	.95	1.40	.....	.....	.....
Machias Junction, N. Y.	.65	.65	.65	.....	.65	.65
Milton, N. H.	.....	.....	1.75	.....	1.25	1.00
Montoursville, Penn.	1.00	.70	.75	.50	.40	.40
Northern New Jersey	.30–.50	.30–.50	.90–1.25	.....	.90–1.25	.....
South Portland, Me.	.....	1.25	2.75	2.50	2.50	2.50
Washington, D. C.	.55	.55	1.20	1.20	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.60	.30	.30	.40	.40	.40
Appleton, Minn.	.....	.50	1.25	.....	1.50	.....
Attica, Ind.	.....	.....	All sizes .75–.85			
Barton, Wis.	.....	.40	.50	.60	.60	.60
Cincinnati, Ohio	.55	.55	.80	.80	.80	.80
Crystal Lake, Ill.	.30	.15	.25	.30	.30	.40
Des Moines, Iowa	.40–.60	.60–.80	1.50–1.70	1.50–1.70	1.50–1.70	1.50–1.70
Eau Claire, Wis.	.40	.40	.55	.85	.85	.....
Elkhart Lake and Glenbeulah, Wis.	.60	.30	.50	.50	.50	.50
Grand Rapids, Mich.	.....	.50	.....	.80	.80	.70
Hamilton, Ohio	.65–.75	.65–.75	.65–.75	.65–.75	.65–.75	.65–.75
Hersey, Mich.	.....	.50	.....	.....	.70	.70
Humboldt, Iowa	.40–.50	.40–.50	1.10–1.30	1.10–1.30	1.10–1.30	1.10–1.30
Indianapolis, Ind.	.50.–.60	.25–.60	.40–.60	.45–.75	.45–.75	.45–.75
Kalamazoo, Mich.	.....	.80	1.05	1.05	1.05	1.05
Kansas City, Mo.	.70	.70	.....	.....	.....	.....
Mankato, Minn.	.55	.45	1.25	1.25	1.25	.....
Mason City, Iowa	.50	.50	.85	1.25	1.25	1.25
Milwaukee, Wis.	.....	.86	.86	.96	.96	.96
Minneapolis, Minn.	.35	.35	1.25	1.35	1.35	1.25
St. Paul, Minn. (e)	.35	.35	1.25	1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Urbana, Ohio	.65	.55	.65	.65	.65	.65
Waukesha, Wis.	.....	.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	.50	1.10	1.00	1.00
SOUTHERN:						
Brewster, Fla.	.40	.40	.....	.....	.....	.....
Charleston, W. Va.	.70	1.25	1.25	.....	.....	.....
Eustis, Fla.	.....	.40–.50	.....	.....	.....	.....
Fort Worth, Texas	.75	.75	1.00	1.00	1.00	1.00
Knoxville, Tenn.	.60–1.00	.80–1.10	.....	.....	1.20	1.20
Roseland, La.	.20	.20	.70	.70	.60	.....
WESTERN:						
Los Angeles, Calif.	.10–.40	.10–.40	.20–.90	.50–.90	.50–.90	.50–.90
Oregon City, Ore.	3.00–3.50g	1.00–1.50	1.00–1.50	1.00–1.50	1.00–1.50	1.00–1.50
Phoenix, Ariz.	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.80	.60	.....	1.20	1.15	1.15
Seattle, Wash.	1.25*	1.25*	1.00*	1.00*	1.00*	1.25*

*Cu. yd. ‡Delivered on job by truck. (e) Prices f.o.b. N. P. Ry.

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; per ton f.o.b. plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.00	2.00	2.25	1.50	.....	4.00	.....
Cheshire, Mass.		Sand for soap, 7.00–8.00				6.00–8.00	.....
Eau Claire, Wis.	.....	.....	.....	.....	.....	2.50–3.00	.....
Elco, Ill.	Soft amorphous silica, 92%–99% thru 325 mesh, 18.00–40.00 per ton						
Kasota, Minn.	.....	.....	.....	.....	.....	.....	1.00
Montoursville, Penn.	.....	.....	.....	1.35–1.50	.....	.....	.....
New Lexington, Ohio	.....	1.75–2.00	1.25–1.50	.....	.....	.....	.....
Ohlton, Ohio	1.75*	1.75*	.....	2.00*	1.75*	1.75*	.....
Ottawa, Ill.	1.25–3.25	2.25–3.50	1.25–3.25	1.25–3.25	1.25	3.50	3.50
Red Wing, Minn. (a)	.....	.....	.....	.....	1.50	3.00	1.50
San Francisco, Calif.	3.50†	5.00†	3.50†	2.50–3.50†	5.00†	3.50–5.00†	.....

†Fresh water washed, steam dried. *Damp. (a) Filter sand, 3.00.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio	.....	1.50
Eau Claire, Wis.	4.30	1.00
Montoursville, Penn.	.....	1.00
Ohlton, Ohio	1.75	1.75
Ottawa, Ill.	1.25–3.25	1.25
Red Wing, Minn.	.....	1.00
San Francisco, Calif.	3.50	3.50
Silica, Va.	.....	1.75

Glass Sand

(Silica sand is quoted washed, dried and screened)

Cheshire, Mass., in carload lots	5.00–7.00
Klondike, Mo.	2.00
Ohlton, Ohio	2.50
Ottawa, Ill.	1.25
Red Wing, Minn.	1.50
San Francisco, Calif.	4.00–5.00
Silica and Mendota, Va.	2.50–3.00

Bank Run Sand and Gravel

Appleton, Minn.†	.55
Algonquin, Ill.¶ (½-in. and less)	.30
Brewster, Fla. (sand, ¼-in. and less)	.40–.50
Burnside, Conn. (sand, ¼-in. and less)	.75*
Chicago, Ill., and Grand Haven, Mich.†	.92–1.20
Crystal Lake, Ill.¶ (½-in. and less)	.25
Des Moines, Ia. (sand and gravel mix)	.60–1.05
Fort Worth, Tex.¶ (2-in. and less)	.65
Gainesville, Tex.¶ (1-in. and less)	.55
Gary and Miller, Ind.†	1.15–1.40a
Grand Rapids, Mich.¶ (1-in. and less.)	.55
Hamilton, Ohio¶ (1½-in. and less)	.50–1.00
Hersey, Mich.¶ (1-in. and less)	.50
Kalamazoo, Mich.	1.85b
Mankato, Minn.†	.70
Oregon City, Ore.—All sizes at bunkers	1.00–1.50
Pueblo, Colo.—†River run sand	.50
Winona, Minn.†	.60
York, Penn. Sand. ¼-in. and less, 1.00; 1/10-in. down	1.10

*Cubic yard. †Fine sand. 1/-10-in. down. (a) Cu. yd., delivered Chicago. (b) 1½ cu. yd. ¶Gravel.

Current Price Quotations

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations.

Portland Cement

	F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.82½	3.30	4.30¶
Atlanta, Ga.	.....	2.19†	3.49¶
Baltimore, Md.	.....	2.26†	3.56¶
Berkeley, Calif.	.....	2.14	.....
Birmingham, Ala	.....	1.85†	3.15¶
Boston, Mass.	.47	1.88†	3.27¶
Buffalo, N. Y.	.51¼	2.05†	3.35¶
Butte, Mont.	.90¼	3.61	.....
Cedar Rapids, Ia.	.....	2.23*	.....
Centerville, Calif.	.....	2.14	.....
Charleston, S. C.	.....	a2.29†	3.26¶
Cheyenne, Wyo.	.61½	2.46	.....
Chicago, Ill.	.....	1.95*	3.25¶
Cincinnati, Ohio	.....	2.14*	3.44¶
Cleveland, Ohio	.....	2.04*	3.34¶
Columbus, Ohio	.....	2.12†	3.47¶
Dallas, Texas	.....	†1.90–2.20	3.49¶
Davenport, Iowa	.....	2.14*	.....
Dayton, Ohio	.....	2.14†	3.44¶
Denver, Colo.	.66¼	2.65	.....
Des Moines, Iowa	.48½	1.94	.....
Detroit, Mich.	.....	1.95*	3.25¶
Duluth, Minn.	.....	2.04*	.....
Fresno, Calif.	.....	2.33	.....
Houston, Texas	.....	†2.00–2.30	3.73¶
Indianapolis, Ind.	.54¾	1.99*	3.29¶
Jackson, Miss.	.....	2.29†	3.59¶
Jacksonville, Fla.	.....	b2.34†	3.26¶
Jersey City, N. J.	.....	2.13†	3.43¶
Kansas City, Mo.	.50½	2.02	3.22¶
Los Angeles, Calif.	.43	1.72	.....
Louisville, Ky.	.55½	2.12–2.15†	3.42¶
Memphis, Tenn.	.....	2.29†	3.59¶
Merced, Calif.	.....	2.01	.....
Milwaukee, Wis.	.....	2.10*	3.40¶
Minneapolis, Minn.	.....	2.27*	.....
Montreal, Que.	.....	1.60‡	.....
New Orleans, La.	.43	1.92†	3.22¶
New York, N. Y.	.50¾	2.03†	3.33¶
Norfolk, Va.	.....	1.97†	3.27¶
Oklahoma City, Okla.	.61½	2.46	3.66¶
Omaha, Neb.	.59	2.36	3.56¶
Peoria, Ill.	.....	2.12*	3.32¶
Pittsburgh, Penn.	.....	1.95*	3.25¶
Philadelphia, Penn.	.....	2.15†	3.45¶
Phoenix, Ariz.	.....	3.51	.....
Portland, Ore.	.....	2.50†	.....
Reno, Nev.	.....	2.96†	.....
Richmond, Va.	.....	2.32†	3.62¶
Sacramento, Calif.	.....	2.25	.....
Salt Lake City, Utah	.70¼	2.81	.....
San Antonio, Texas.	.....	.....	3.42¶
San Francisco, Calif.	.....	2.24†	.....
Santa Cruz, Calif.	.....	2.10	.....
Savannah, Ga.	.....	a2.29†	3.16¶
St. Louis, Mo.	.48¾	1.95†	3.25¶
St. Paul, Minn.	.....	2.27*	.....
Seattle, Wash.	.....	1.75–1.90	.....
Tampa, Fla.	.....	2.00†	3.41¶
Toledo, Ohio	.....	2.20*	3.50¶
Topeka, Kan.	.55¼	2.21	3.41¶
Tulsa, Okla.	.58¼	2.33	3.53¶
Wheeling, W. Va.	.....	2.02†	3.32¶
Winston-Salem, N.C.	.....	2.44†	3.54¶
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Albany, N. Y.	.....	2.15	.....
Bellingham, Wash.	.....	2.25	.....
Bonner Springs, Kan.	.....	1.85	.....
Buffington, Ind.	.....	1.70	.....
Chattanooga, Tenn.	.....	2.05	.....
Concrete, Wash.	.....	2.65	.....
Davenport, Calif.	.....	2.05	.....
Hannibal, Mo.	.....	1.90	.....
Hudson, N. Y.	.....	1.85†	.....
Leeds, Ala.	.....	1.65	.....
Limedale, Ind.	.....	1.70	.....
Lime & Oswego, Ore.	.....	2.50	.....
Mildred, Kan.	.....	2.35	.....
Nazareth, Penn.	.....	2.15	.....
Northampton, Penn.	.....	1.75	.....
Richard City, Tenn.	.....	2.05	.....
Steelton, Minn.	.....	1.85	.....
Toledo, Ohio	.....	2.20	.....
Universal, Penn.	.....	1.70	.....

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. *Includes dealer and cash discounts. †Includes 10c cash discount. (a) 44c refund for paid freight bill. (b) 38c bbl. refund for paid freight bill. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. ‡Includes sales tax.

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.25	1.25	1.25	1.25	1.25	1.25
Chazy, N. Y.	.75	1.60	1.60	1.30	1.30	1.30
Farmington, Conn.	.....	1.30	1.10	1.00	1.00	.....
Ft. Spring, W. Va.	.35	1.35	1.35	1.25	1.15	1.00
Jamesville, N. Y.	1.00	1.00	1.00	1.00	1.00	1.00
Oriskany Falls, N. Y.	.50–1.00	1.00–1.35	1.00–1.35	1.00–1.35	1.00–1.35	1.00–3.00
Prospect Junction, N. Y.	.50– .80	1.15u	1.15	1.10	1.10	1.10
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
Hillsville, Penn.	.85	1.35	1.35	1.35	1.35	1.35
Shaw's Junction, Penn. (e)	.85	1.20–1.35	1.20–1.35	1.20–1.35	1.40	1.30–1.35
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill. (b)	2.00	.....	2.00	.....	.....	.....
Afton, Mich.	.....	.....	.....	.25	.50– .75	1.50
Cypress, Ill.	.90	.90	.90	.90	1.00	1.15
Davenport, Iowa	1.20	1.50	1.50	1.30	1.30	1.30
Dubuque, Iowa	1.00	1.10	1.10	1.10	1.10	.....
Dundas, Ont.	.50	.80	.80	.70	.70	.....
Stolle and Falling Springs, Ill.	1.05–1.70	.95–1.70	1.15–1.70	1.05–1.70	1.05–1.70	.....
Greencastle, Ind.	1.25	1.10	1.10	1.00	1.00	1.00
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
McCook, Ill.	.80	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.75–1.00	1.65–1.85	1.45	1.15	1.05	.95
Sheboygan, Wis.	1.00	1.00	1.00	1.00	1.00	1.00
Stone City, Iowa	.75	.....	1.10	1.00	1.00	1.00h
Toledo, Ohio	1.60	1.70	.....	1.60	.....	1.60
Toronto, Canada	2.50	2.50	2.50	2.50	2.50	2.50
Waukesha, Wis.	.....	.90	.90	.90	.90	.90
Wisconsin points..	.50	.....	1.00	.90	.90	.....
SOUTHERN:						
Cartersville, Ga.	1.00	1.50	1.50	1.25	1.00	1.00
Chico and Bridgeport, Texas	1.00	1.15	1.20	1.15	1.00	1.00
Cutler, Fla.	.50r	1.75r	1.75r	1.75r	1.75r	1.50r
El Paso, Texas (v)	.50	1.25	1.25	1.00	1.00	1.00
Graystone, Ala.	Crusher run stone 1.00 per net ton					
Olive Hill, Ky.	.50–1.00	1.00	1.00	.90	.90	.90
Rocky Point, Va.	.50– .75	1.40–1.60	1.30–1.40	1.15–1.25	1.10–1.20	1.00–1.05
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.70
Blue Springs and Wymore, Neb. (t)	.25	.25	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.00	1.25	1.00	1.00	1.00	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
Rock Hill, St. Louis, Mo.	1.45	1.45	1.45	1.45	1.45	1.45
Stringtown, Okla.	1.00	1.15	1.20	1.15	1.00	1.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35	.....	1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Farmington, Conn.	1.00	1.30	1.30	1.00	1.00	.....
Duluth, Minn.	1.00	2.25	1.75	1.65	1.35	1.25
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	1.15	1.25	1.50	1.30	1.15	1.10
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	.....	2.10	1.60–1.90	1.40–1.50	1.40–1.50	.....
Richmond, Calif.	.50	.....	1.00	1.00	1.00	.....
Toronto, Canada	4.70	5.80	4.05	4.05	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Cayce, S. C.—Granite	.50	1.60	1.60	1.60	1.50	1.50
Chicago, Ill.—Granite	2.00	1.70	.....	1.50	1.50	.....
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.—Granite	.50	1.75	1.50	1.25	1.25	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00–3.50	.....	2.00–2.25	2.00–2.25	.....	1.25–3.00
Toccoa, Ga.—Granite	.50	1.35	1.35	1.25	1.25	1.20

(b) Wagonloads. (c) 1 in., 1.40. (d) 2-in., 1.30. (e) Price net after 10c discount deducted. (h) Rip rap. (n) Ballast, R. R., .90; run of crusher, 1.00. (q) Crusher run, 1.40; ¼-in. granlithic finish, 3.00. (r) Cu. yd. (t) Rip rap, 1.20–1.40 per ton. (u) ⅝-in. and less. (v) Roofing stone, 1.50 per ton.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Allentown, Penn.	1.00–1.50	.40– .60	.80–1.00	.50– .80	.50– .80	.60– .80	.80
Bethlehem, Penn.	1.25–1.75	.50– .70	1.00–1.25	.60– .80	.70– .80	.70– .90	.90
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Hokendauqua, Penn.	1.50	.70	1.00	1.15	1.15	1.15	1.15
Reading, Penn.	2.00	1.00	.....	1.00	.....	.....	.....
Swedeland, Penn.	1.50–2.50	.60–1.10	1.00–1.25	.90–1.25	.90–1.25	1.25	1.25
Western Pennsylvania	2.00	1.25	1.25	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	.....	1.30*	1.80*	1.45*	1.45*	1.45*	1.45*
Jackson, Ohio	.....	.65*	1.80*	1.30*	1.30*	1.30*	1.30*
Toledo, Ohio	1.50	1.10	1.35	1.35	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.	.....	1.05*	1.80*	1.45*	1.45*	1.45*	1.45*
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.80
Longdale, Va.	2.50	.75	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05	.55*	.....	1.15*	.90*	.90*	.....

5c per ton discount on terms. †1¼ in. to ¼ in., 1.05; ⅝ in. to 10 mesh, 1.25*; ⅝ in. to 0 in., 90*; ¼ in. to 10 mesh, .80*.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 99% $CaCO_3$; 0.3% $MgCO_3$, 90% thru 100 mesh 4.50

Belfast, Me.—Analysis, $CaCO_3$, 90.4%; $MgCO_3$, trace; 90% thru 100 mesh, per ton 10.00

Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh 1.50

Cartersville, Ga. 2.00

Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, per ton 6.00

Gibsonburg, Ohio—Bulk, 2.25; in bags.. 3.70

Hillsville, Penn. 2.10–4.50

Joliet, Ill.—Analysis, 50% $CaCO_3$; 44% $MgCO_3$; 90% thru 200 mesh 3.50

Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, bags, 3.75; bulk 2.50

Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton 2.00

Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh 4.25

West Rutland, Vt. — Analysis, 96.5% $CaCO_3$; 1% $MgCO_3$, in 100-lb. burlap bags, per ton 4.50

Agricultural Limestone

(Crushed)

Bedford, Ind.—Analysis, 98% $CaCO_3$; 1% $MgCO_3$; 90% thru 10 mesh; 30% thru 100 mesh 1.50

Cartersville, Ga.—50% thru 50 mesh 1.50

Chico and Bridgeport, Texas—Analysis, 95% $CaCO_3$; 1.3% $MgCO_3$; 50% thru 50 mesh 1.00

Colton, Calif.—Analysis, 95-97% $CaCO_3$; 1.31% $MgCO_3$, all thru 14 mesh down to powder 3.50

Cypress, Ill.—Analysis, 96% $CaCO_3$; 90% thru 100 mesh, 1.25; 50% thru 100 mesh, 1.25; 90% thru 50 mesh, 1.25; 50% thru 50 mesh, 1.15; 90% thru 4 mesh, 1.25, and 50% thru 4 mesh 1.15

Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 4 mesh, 50% thru 20 mesh; bulk, per ton 1.20

Dubuque, Ia.—Analysis, 64.04% $CaCO_3$; 29.54% $MgCO_3$; 50% thru 50 mesh 1.00

Dundas, Ont.—Per ton 1.00

Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh; bulk, per ton 1.15–1.50

Gibsonburg, Ohio—90% thru 10 mesh.... 1.00–1.50

Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh, sacked 5.00

Jamesville, N. Y.—Analysis, 89% $CaCO_3$; 4% $MgCO_3$; 90% thru 100 mesh; in paper bags, 5.10; bulk 3.85

Lannon, Wis. — Analysis, 54% $CaCO_3$ 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh 2.00

Screenings (¼ in. to dust) 1.00

Marblehead, Ohio—90% thru 100 mesh.... 3.00

90% thru 50 mesh 2.00

90% thru 4 mesh 1.00

McCook and Gary, Ill.—Analysis, 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh ..... .80

Olive Hill, Ky.—90% thru 4 mesh ..... .50

Osborne, Penn.—50% thru 100 mesh..... 3.50–5.00

Rocky Point, Va.—50% thru 200 mesh, bulk, in carloads, 2.00; 100-lb. paper bags, 3.25; 200-lb. burlap bags 3.50

Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh 1.15–1.70

Stone City, Iowa — Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75

West Stockbridge, Mass.* — Analysis, 95% $CaCO_3$; 90% thru 100 mesh, bulk 100-lb. paper bags, 4.75; 100-lb., cloth 5.25

Waukesha, Wis.—90% thru 100 mesh, 4.00; 50% thru 100 mesh 2.10

*Less 25c cash 15 days.

Pulverized Limestone for Coal Operators

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton 6.00

Hillsville, Penn.. sacks, 5.10; bulk 3.50

Joliet, Ill.—Analysis, 50% $CaCO_3$; 44% $MgCO_3$; 90% thru 200 mesh (bags extra) 3.50

Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk 2.25–3.50

Waukesha, Wis.—90% thru 100 mesh, bulk 4.00

Lime Products

(Carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime In bulk	Lump lime In bbl.
EASTERN:								
Berkeley, R. I.			11.40			17.50		20.65
Knickerbocker, Devault and Rambo, Penn.*		9.50	9.50	9.50	8.00	9.50	8.50	
Lime Ridge, Penn.			8.75		6.50	8.00[3]	5.00	
CENTRAL:								
Afton, Mich.						10.00	6.50	
Carey, Ohio	9.50	6.50	6.50		8.00		8.00	
Cold Springs, Ohio		7.75	7.75				7.00	
Gibsonburg, Ohio	10.50				7.00	9.00[9]	7.50	
Little Rock, Ark.		14.40		14.40			11.90	
Luckey, Ohio*	10.50	7.75	7.75				7.00	
Marblehead, Gibsonburg, Marion, Sandusky, Tiffin and White Rock, Ohio[11]	10.50	7.75	7.75	11.00	7.00	9.00	7.00	
Milltown, Ind.		9.00	8.25	9.50	7.50		7.00	
Scioto, Ohio	9.75–10.50	6.00– 7.50	6.00– 7.50	7.00– 7.50			6.00	
Sheboygan, Wis.		10.50	10.50				9.50	9.50
Wisconsin points		11.50					9.50	
Woodville, Ohio	10.50	7.75	7.75	11.50[24]	7.00	9.00*	7.00	
SOUTHERN:								
Cartersville, Ga.		9.00				13.50		15.00
Graystone, Ala.*	12.50	9.00		12.50			7.50	
Keystone, Ala.	17.00	9.00		7.00– 9.00			5.00a	14.85
Knoxville, Tenn.	10.50	7.00– 9.00	7.00– 9.00	7.00			4.75‡	10.50¶
Ocala, Fla.		11 00						
Pine Hill, Ky.		9.00	8.00	9.00				12.50
WESTERN:								
Colton, Calif.					9.50[4]			
Kirtland, N. M.							15.00	20.00
Los Angeles, Calif.							12.00	
San Francisco, Calif.†	16.00	14.00	6.00–12.00	14.00–19.00	14.50[20]		11.00[19]	
San Francisco, Calif.	19.00	14.00–17.00	12.50	14.00–19.00	14.50[20]		11.00[19]	

[1]Also 6.00. [2]To 1.35. [3]In 100-lb. bags. [4]To 11.85 per ton, granular but not ground, ¼-in. screen down to 14 mesh. [9]In 80-lb. paper. [10]Per bbl. [11]Lump lime, per bbl., in steel, 1.60; steel with wooden heads, 1.55, and in wood, 1.50. [19]Less credit for return of empties. [20]To 14.50. [24]Also 13.00. [24]Superfine, 92.25% thru 200 mesh. *Price to dealers. †Wood-burnt lime: finishing hydrate 20.00 per ton, pulv. lime 2.00 per iron drum. Oil-burnt pulv. lime, 13.00–14.50 per ton. ‡To 6.00. ¶To 13.50. (a) To 8.50.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 100% thru 200 mesh, 7.00 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton.

Granville, N. Y.—Red, green and black, $7.50 per ton.

Pen Argyl, Penn.—Blue-black, 6.50 per ton in bulk, plus 10c per bag.

Roofing Slate

Prices per square—Standard thickness.

City or shipping point:	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—						
Buckingham oxford grey	13.88	17.22	24.99	29.44	34.44	45.55
Bangor, Penn.—No. 1 clear	10.00–14.00	20.00	25.00	29.00	40.00	50.00
No. 1 ribbon	9.00–10.25	16.00	20.00	25.00	35.00	46.00
Gen. Bangor No. 2 ribbon	6.75– 7.25					
Gen. Bangor mediums	9.00–10.50					
Chapman Quarries, Penn.	7.75–11.25	13.00–15.00	19.00–22.00	23.00–28.00	27.00–30.00	32.00–35.00
Granville, N. Y.—						
Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green & gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple & unfading gr'n	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Monson, Maine	19.80	24.00				
Pen Argyl, Penn.*						
Graduated slate (blue)		16.00	23.00	27.00	37.00	46.00
Graduated slate (grey)		18.00	25.00	29.00	39.00	48.00
Color-tone	11.50–12.50; Vari-tone, 12.00–13.00; Cathedral gray, 14.00–15.00					
No. 1 clear (smooth text)	7.25–10.50; No. 1 clear (rough text), 8:25–9.50					
Albion-Bangor medium	8.00–9.00; No. 2 clear, 8.00–9.00; No. 1 ribbon, 8.00–8.50					
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1 clear	9.50	18.00	22.00	26.00	36.00	46.00
Blue Mountain No. 2 clear	8.00	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.
*Unfading grey, 14.00–15.00; 10% disc. to roofer; 10%–8½% to wholesaler.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:
- Crude talc, per ton 5.00
- Ground talc (20-50 mesh), bags 6.50
- Ground talc (150-200 mesh), bags 9.00
- Pencils and steel crayons, gross 1.50– 2.00

Chester, Vt.—Finely ground talc (carloads), Grade A—99-99¼% thru 200 mesh, 8.00–8.50; Grade B, 97-98% thru 200 mesh 7.50– 8.00
1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of bags. Terms 1%, 10 days.

Clifton, Va.:
- Crude talc, per ton 4.00
- Ground talc (150-200 mesh), in bags 12.00

Conowingo, Md.:
- Crude talc, bulk 4.00
- Ground talc (150-200 mesh), in bags 14.00
- Cubes, blanks, per lb. ..... .10

Emeryville, N. Y.:
- Ground Talc (200 mesh), bags 13.75
- Ground talc (325 mesh), bags 14.75

Hailesboro, N. Y.:
- Ground talc (300-350 mesh) in 200-lb. bags 15.50–20.00

Henry, Va.:
- Crude (mine run), bulk 3.50– 4.25
- Ground talc (150-200 mesh), bags 6.25– 9.75

Joliet, Ill.:
- Ground talc (200 mesh) in bags:
- California white 30.00
- Southern white 20.00
- Illinois talc 10.00

Los Angeles, Calif.:
- Ground talc (150-200 mesh), in bags 14.00–25.00

Natural Bridge, N. Y.:
- Ground talc (325 mesh), bags 10.00–15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70% 3.50–4.00
Mt. Pleasant, Tenn.—B.P.L. 76-78% 6.75

Ground Rock
(2000 lb.)

Gordonsburg, Tenn.—B.P.L. 65–70% 3.75– 4.30
Mt. Pleasant, Tenn. — Lime phosphate:
- B.P.L. 73.25% 11.80

Mt. Pleasant, Tenn.—B.P.L., 72% 5.00– 5.50

Florida Phosphate

(Raw Land Pebble)
(Per Ton)

Mulberry, Fla.—Gross ton, f.o.b. mines
- 68/66% B.P.L. 3.15
- 70% minimum B.P.L. 3.75
- 72% minimum B.P.L. 4.25
- 75/74% B.P.L. 5.25
- 77/76% B.P.L. 6.25

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton 100.00–125.00
- Punch mica, per lb. ..... .06
- Scrap, per ton, carloads 20.00

Rumney Depot, Bristol and Cardigan, N. H.—Per ton:
- Punch mica, per ton 150.00–240.00
- Mine scrap 22.50
- Mine run 325.00
- Clean shop scrap 25.00
- Roofing mica 37.50
- Trimmed mica, per ton, 20 mesh, 37.50; 40 mesh, 40.00; 60 mesh, 40.00; 100 mesh, 45.00; 200 mesh 60.00

Spruce Pine, N. C.—Mine scrap, per ton 20.00

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x 36". Per M Sq. Ft.	—Plaster Board— ⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
Acme, Tex.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Blue Rapids, Kan.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Centerville, Iowa			6.00	7.00		7.50	8.50	10.50a					
East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton, floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 6 in. long, 17c per ft., 23.00 per ton.													
Fort Dodge, Iowa	2.50	6.00	6.00	7.00	9.00	9.00	11.50	8.00	16.00	20.00	15.00		25.00
Grand Rapids, Mich. (h)			7.00	9.00	9.00d	9.50d	19.50	8.00d	26.00	20.00d			25.00
Los Angeles, Calif. (b)		7.00–9.00	7.00–9.00	7.50–9.00	8.00–10.00		8.00–10.00		30.00e				
Medicine Lodge, Kan.	1.45				11.50d		11.50d		16.00d	11.50d			
Oakfield, N. Y.	3.00			6.00	9.00d	9.00d		6.00					
Port Clinton, Ohio	3.00	4.00	6.00	9.00	9.00	9.00	20.00	8.00	25.50	20.00i		15.00	25.00
Portland, Colo.		7.00	7.00	9.00	9.00	9.50	9.00		27.50		22.50	27.50	
Providence, R. I. (x)				12.00–13.00e									
Seattle, Wash. (z)	6.00	9.00	9.00	13.00			14.00						
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00					20.00	25.00g	33.00f

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) White molding. (b) Plasterboard, ¼x32x36-in., 14c-17c per sq. ft.; ⅜x32x36-in., 15c-18c per sq. ft. (c) To 40.00. (d)Includes paper bags. (e) Includes jute sacks. (f) "Gyproc," ⅜x48-in. by 5 and 10 ft. long. (g) ½x48-by 3 to 4 ft. long. (h) Gypsum lath, per M sq. ft., 15.00. (i) To 26.00. (x) "Fabricaste" gypsum blocks, 2- and 3-in., f.o.b. motor trucks at plant, 7¼c-8¼c. Block setting plaster, per ton, in jute sacks, 12.00. (y) Jute sacks, 18.00; paper sacks, 16.00. (z) Gypsum partition tile, 3-in., 9c per sq. ft.; 4-in., 11c per sq. ft.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	‖12.50–‖14.50	‖12.50–‖14.50
Cranberry Creek, N. Y.—Bio-Spar, per ton in bags in carload lots, 9.00; less than carload lots, 12.00 per ton in bags, bulk, per ton		7.50
Crown Point, N. Y.—Mica Spar		¶9.00–‖12.00
Davenport, Iowa — White limestone, in bags, per ton	‖6.00	‖6.00
Harrisonburg, Va.	12.50–14.50	
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt.—Middlebury white		¶9.00–‖10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		c5.50
Phillipsburg, N. J.		16.00–18.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Stockton, Calif. — Colored rock aggregate		6.00–18.00
Tuckahoe, N. Y.—Tuckahoe white	7.00	
Warren, N. H. (d)		¶8.00– 8.50
Whitestone, Ga.		10.00

‖C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb. (c) Per ton f.o.b. quarry in carloads; 7.00 per ton L.C.L. (d) L.C.L., 9.50–15.00 ton in 100-lb. bags.

Soda Feldspar

De Kalb Jct., N. Y.—Color, white; pulverized (bags extra, burlap 2.00 per ton, paper 1.20 per ton); 99% thru 140 mesh, 16.00; 99% thru 200 mesh, per ton — 18.00

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140 mesh (bulk) — 19.00

Keystone, S. D.—Color, white; analysis, K_2O, 13.25%; Na_2O, 2.10%; SiO_2, 64%; Fe_2O_3, .03%; Al_2O_3, 20%, pulverized, 99% thru 200 mesh, in bags, 15.00; bulk — 15.00
Crude, in bags, 9.00; bulk — 8.00

Coatesville, Penn.—Color, white; analysis, K_2O, 12.30%; Na_2O, 2.86%; SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; crude, per ton — 8.00

Erwin, Tenn.—White; analysis, K_2O, 10%; Na_2O, 2.75%; SiO_2, 68.25%; Fe_2O_3, .10%; Al_2O_3, 18.25%, pulverized 98% thru 200 mesh, in bags, 17.20; bulk — 16.00
Crude, in bags, 8.50; bulk — 7.50

Rumney and Cardigan, N. H. — Color, white; analysis, K_2O, 9-12%; Na_2O, trace; SiO_2, 64-67%; Al_2O_3, 17-18%, crude, bulk — 7.00– 7.50

Rumney Depot, N. H.—Color, white; analysis, K_2O, 8-13%; Na_2O, 1-1½%; SiO_2, 62-68%; Al_2O_3, 17-18%, crude, bulk — 7.00– 7.50

Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; pulverized, bulk (bags, 15c extra) — 18.00

Cement Drain Tile

Graettinger, Iowa. — Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in. 1.35; 36-in. — 2.00

Grand Rapids, Mich.—Drain tile, per 1000 ft.

4-in.	36.00
5-in.	48.00
6-in.	66.00
8-in.	100.00
10-in.	150.00
12-in.	210.00

Longview, Wash.—Drain tile, per 100 ft.

3-in.	5.00
4-in.	6.00
6-in.	10.00
8-in.	15.00

Tacoma, Wash.—Drain tile, per 100 ft.

3-in.	4.00
4-in.	5.00
6-in.	7.50
8-in.	12.00

Chicken Grits

Centerville, Iowa	9.25
Cypress, Ill.—(Agstone)	1.15
Belfast, Me.—(Agstone), per ton, in carloads	10.00
Chico. Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per 100-lb. sack	1.50
Coatesville, Penn.—(Feldspar), per ton, in bags of 100 lb. each	8.00
Cranberry Creek, N. Y.—Per ton, in carload lots, in bags, 9.00; bulk, 7.50. Less than carload lots, in bags	12.00
Davenport, Iowa — High calcium carbonate limestone, in bags L.C.L., per ton	6.00
El Paso, Texas—(Limestone) per 100-lb. sack	.75
Los Angeles, Calif.—Per ton, including sacks: Gypsum	7.50 –9.50
Middlebury, Vt.—Per ton (a)	10.00
Randville, Mich.—(Marble), bulk	6.00
Seattle, Wash.—(Gypsum), bulk, ton	10.00
Warren, N. H.	8.50– 9.50
Waukesha, Wis.—(Limestone), per ton	7.00
West Stockbridge, Mass.	¶7.50–‖9.00
Wisconsin Points—(Limestone), per ton	15.00

(a) F.o.b. Middlebury, Vt. ¶C.L. ‖L.C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton Wis.	10.50
Dayton, Ohio	12.50–13.50
Detroit, Mich. (d)	13.00–16.00*b
Farmington, Conn.	16.00
Grand Rapids, Mich.*	14.50
Iona, N. J.	12.00
Jackson, Mich.	13.00
Madison, Wis.	12.50a
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	9.00*
Mishawaka, Ind.	11.00
New Brighton, Minn.	8.00
Pontiac, Mich. (e)	15.50
Portage, Wis.	15.00
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	12.50
Sebewaing, Mich.	12.50
South River, N. J.	11.00
South St. Paul, Minn.	9.00
Syracuse, N. Y.	18.00–20.00
Toronto, Canada	b13.00–15.00*
Winnipeg, Canada	15.00

Delivered on job. (a) Less 50c disc. per M 10th of month. (b) 5% disc., 10 days. (c) Delivered in city. (d) Also 15.50. (e) Truck delivery.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

City or shipping point	Size 8x8x16
Appleton, Minn.	18.00–20.00
Chicago, Ill., district: 8x8x16. Per 1000	180.00
Chicago, Ill.:	
8x 8x16. Each	.21†
8x 8x16. Each	.18b
8x10x16. Each	.26†
8x10x16. Each	.23b
8x12x16. Each	.30†
8x12x16. Each	.27b
Columbus, Ohio	14.00b–16.00†
Forest Park, Ill.	21.00*
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12a
Lexington, Ky.:	
8x8x16	a18.00*
8x8x16	b15.00*
Los Angeles, Calif.:	
4x8x12	4.50*
4x6x12	3.90*
4x4x12	2.90*

*Price per 100 at plant.
†Rock or panel face.
(a) Face. (b) Plain. (c) Common.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Clyde, Ill.—French tile, 9x15-in., per sq., 9.50–‖1.50; Spanish, 9x15-in., per sq., 10.00–12.00; Shingle, 9x12-in., per sq. 11.00–13.00
Detroit, Mich.—5x8x12, per M — 67.50
Indianapolis, Ind.—9x15-in.

	Per sq.
Gray	10.00
Red	11.00
Green	13.00

Lexington, Ky.—8x15, per sq.:

Red	15.00
Green	18.00

Longview, Wash.:

4x6x12-in., per 1000	55.00
4x8x12-in., per 1000	65.00

Cement Building Tile

Chicago District (Haydite):

8x 4x16, per 1000	140.00
8x 8x16, per 1000	200.00
8x12x16, per 1000	300.00

Columbus, Ohio:

5x8x12, per 100	6.00

Lexington, Ky.:

5x8x12, per 1000	55.00
4x5x12, per 1000	35.00

Longview, Wash. (Stone Tile):

4x6x12, per 1000	57.50
4x8x12, per 1000	65.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Camden & Trenton, N. J.	17.00	
Chicago District "Haydite"	14.00	
Columbus, Ohio	16.00	17.00
Ensley, Ala. ("Slagtex")	10.00–13.00a	
Forest Park, Ill.		17.00
Longview, Wash.	16.50	23.00– 40.00
Milwaukee, Wis.	14.00	
Omaha, Neb.	18.00	30.00– 40.00
Philadelphia, Penn.	15.50	
Portland, Ore.	12.00	22.50– 55.00
Prairie du Chien, Wis.	14.00	22.50
Rapid City, S. D.	18.00	25.00– 40.00

(a) Delivered on job; 10.00 f.o.b. plant.

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00

Stone-Tile Hollow Brick

Prices are net per thousand f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.		53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.		55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans, La.	35.00	45.00	60.00
Norfolk, Va.	35.00	50.00	65.00
Passaic, N. J.	35.00	50.00	65.00
Patchogue, N. Y.		60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% disc.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10 in.	12 in.	15-in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Grand Rapids, Mich. (b)	.....	.13½	.21	.31½	.40½	.64	1.00	.....	.....	1.80	.....	.....	.....	.....	.....	.....	.....
Culvert	.....	.....	.....	.60	.70	1.00	1.20	.....	.....	1.80	2.10	2.25	3.35	4.00	5.60	6.90	7.85
Indianapolis, Ind. (a)	.....	.....	.....	.75	.85	.90	1.15	.....	.....	1.60	.....	2.50	.....	.....	.....	.....	.....
Newark, N. J. (d)	.....	.....	.....	.....	.85	.95	1.25	1.40	1.56	2.09	2.30	3.15	4.05	5.15	6.35	7.65	.....
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Tiskilwa, Ill. (rein.)	.....	.....	.....	.75	.85	.95	1.20	1.60	.....	2.00	.....	2.75	3.40	.....	6.50	.....	10.00
Tacoma, Wash.	.15	.17	.22½	.30	.40	.55	.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wahoo, Neb. (c)	.....	.....	.....	.....	.85½	.....	1.14	.....	.....	1.81	.....	2.47	3.42	4.13	5.63	6.49	7.31

(a) 24-in. lengths. (b) Sewer, 21-in., 1.40. †21-in. diameter. (c) Reinforced, 15.40 per ton, f.o.b. plant. (d) Reinforced.

John G. Carpenter's Argument on Proposed Standard Sizes of Gravel

Sir: Your characterization of my position on the report of the committee of the National Sand and Gravel Association, recommending six sizes of gravel as a "misconception," is unfair and prejudicial to the best interests of the vast majority of producers. You seem to dismiss the opposition with a glaring insinuation that it is a mere flash in the pan.

[This refers to the report of the annual spring meeting of the directors of the National Sand and Gravel Association, ROCK PRODUCTS, May 24, 1930, p. 73, where Stanton Walker's report on proposed standard sizes was briefly abstracted.—The Editor.]

I think you would rather be right than president and that you intend to shoot straight, but I am afraid that you have yielded to a desire to be on the popular side and put your money on the wrong horse. You surely have created a wrong impression and the least that you can do is to give my real position the same publicity that you have given this misleading reference.

The issues on the six-size proposal are clearly set out in the May issue of the *Empire State Gravelette*. I am sending you another copy. I have sent copies to about every large producer of gravel in the country and I will send a copy upon request to anyone whom I have missed.

The proposal to increase the number of sizes from three to six in the name of simplification is a misnomer and fraught with the gravest consequences.

The qualifying expressions mean nothing. You can't change the nature of a wolf by grafting wool on him. The lightning rod agent calls his pyramiding contract a mere formality. An accommodation indorsement is a mere business courtesy until the note is protested. An "it is not expected" reservation does not pull the wolf's teeth nor satisfy the obligation.

It is as plain as a mountain looming from a plain that the proposal is an entering wedge that is bound to force all producers to ultimately make six sizes. It is an urgent invitation to specification writers to get busy and utilize the six sizes. It would cost the New York producers a million dollars and create a confusion that would plague them for ages to come.

The proposal is so revolutionary, so impractical, so suicidal and so unnecessary that it must go down as a laboratory scheme that has no place in plant operation and is a grave menace to the industry.

The only excuse presented for this strange program is that certain urban areas are afflicted with an epidemic of sizes. The committee would unmercifully and perpetually punish 99% of the producers to correct the folly of 1%.

This committee has a wonderful chance to do a lasting service to the industry by "FIXING THREE STANDARD SIZES OF GRAVEL AND SECURING THE CONCURRENCE OF STATE AND FEDERAL AUTHORITIES IN EXACT SIZES CHOSEN." This is the solution and is bound to prevail because it appeals to reason and will benefit rather than demoralize the industry.

The plan is being received with enthusiasm as our referendum indicates. When the producer once scents the danger in the six sizes proposal and counts the cost, he rebels at the idea. The letters that we have received from members of the committee on six sizes indicates that the program must be modified to include only three sizes.

This is my position on this vital matter and I hope you will present it in the next issue of ROCK PRODUCTS. This is not a controversy between the two associations but a temperate discussion of policies among producers. It is the only policy of the National Association that we have had serious reason to oppose and we feel that we are acting purely in self-defense.

JOHN G. CARPENTER,
Secretary-Treasurer, Empire State Sand and Gravel Producers' Association.
Hamilton, N. Y., May 29, 1930.

* * *

Since, as Mr. Carpenter says, he has sent copies of his discussion to all known sand and gravel producers, and has a supply to send to others interested, it is hardly necessary to reprint it here. It occupies about four pages of his *Gravelette*, about the size of this page.

The substance of Mr. Carpenter's argument seems to be in the following paragraphs:

"From the standpoint of the architect the cost of aggregates is important. If a size that is not produced near the job is insisted upon, the special aggregate will cost more money, just as any special equipment costs more than a standard product. Producers have been losing money on gravel and the tendency is toward higher prices on choice and well graded material. How much it shall go up depends on co-operation of architects and engineers with the producers in keeping the cost of production down. We should avoid special sizes, we should not be too insistent on exact grading and we should co-operate in apportioning deliveries. A product that sells for 80 cents to a dollar per ton does not justify much extra handling nor exact sizing.

"Specifications should be adapted in the first instance to the sizes available where the structure is to be built. This may involve some investigation and expense, but if the expenditure of $50 will save a client $500, the precaution will win his gratitude. If the specifications have to be corrected to meet local conditions, the client is quite liable to think that the plans have been slighted.

"In New York and Pennsylvania the sizes of coarse aggregate generally produced follow state specifications closely and are approximately ¼ to ¾ inch, ¾ to 1½ inches and 1½ to 2½ inches. The mixes generally used are No. 1, ¼ to ¾ inch; No. 2, ¼ to 1½ inches, and No. 3, ¼ to 2½ inches. The percentage of sizes are apportioned from small to large to make a well balanced aggregate.

"It has been the practice of the writer to designate and quote the three sizes as Nos. 1, 2 and 3, and the mixes as No. 1, 1-2, and 1-2-3. This enables one to designate the various grades with few qualifying words. Nearly all plants are equipped to furnish separate sizes as well as mixes. All other sizes are special, and are difficult to procure even at a higher price."

The point of Mr. Carpenter's argument seems to be that the proposed six standard sizes of the National Sand and Gravel Association will tend to eliminate *special* sizes for which it is now possible to ask a *special* price.

Mr. Carpenter's bulletin, unfortunately, does not discuss the subject very dispassionately, and certainly not at all from a scientific viewpoint. In other words, he is looking at it merely from a commercial angle. Stanton Walker, on the other hand, probably is considering it more particularly from an engineering point of view. A meeting of minds is obviously difficult under such circumstances; but there is apparently a misconception of the meaning and importance of national standards. Obviously it would be impossible, not to say undesirable, for some plants to make all six standard sizes. One or more standard sizes might easily be special sizes at many plants—that is, they would be a special product for that operation and entitled to a special price. As the editors of ROCK PRODUCTS see it, standardizing of gravel is hardly more than standardization of nomenclature—of descriptive terms—so that we can all talk a common language. This controversy is proof in itself that we do not.

Blaw-Knox Co. Establishes Lime Department

THE Blaw-Knox Co., Pittsburgh, Penn., announces that William J. Kuntz, president and general manager of the Lime and Hydrate Plants, Inc., of York, Penn., and formerly vice-president and sales manager of the H. Miscampbell Co., Inc., Duluth, Minn., is now connected with it as general manager in charge of its lime plants division. Mr. Kuntz's long experience in this line of business and the Blaw-Knox Co.'s facilities for manufacture place it in a position to serve the lime industry exceedingly well for lime and hydrate plant equipment and specialties.

South Carolina Places Order for 1,000,000 Bbl. of Belgian Cement

VARIOUS SOUTHERN NEWSPAPERS have carried more or less detailed accounts of the placing of orders for 1,000,000 bbl. of Belgian portland cement by the South Carolina state highway commission, all giving a more or less false and garbled idea of the cement tariff situation. The most complete of these stories is in the *Columbia* (S. C.) *State* of May 16, and is as follows:

Holding steadfast to its announced intention, the cement committee of the state highway department yesterday approved the bid of the Carolina Portland Cement Co. of Charleston for 1,000,000 bbl. of the commodity at $2.40 per bbl. after disregarding the proposals of several manufacturers who insisted on attempting to maintain their "price structures." The cement will be of foreign manufacture.

The committee—composed of Ben M. Sawyer, chief highway commissioner; Charles H. Moorefield, state highway engineer, and C. E. Jones, chairman of the state highway commission—will recommend that the bid of the Charleston concern be accepted at the commission's meeting May 22.

"The officials of the department were disappointed at the prices quoted by manufacturers of domestic cement," Mr. Jones said for the committee, "for furnishing 1,000,000 bbl. of cement for use on state highway work already advertised for bids to be received on the 20th of this month. In spite of the large quantity purchase, only two firms submitted proposals that could properly be considered under the department's advertisement."

The Carolina Contractor's Equipment and Supply Co. of Columbia was the only other competitive corporation offering the cement at $2.43 per barrel.

Declaring that the tariff situation regarding cement is "serious," the committee called on the South Carolina delegation in congress to do "everything possible to prevent the imposition of an import duty on cement."

Domestic cement at Columbia is now $2.53, Mr. Jones' statement said. The Carolina Portland Cement Co. and the highway department, should the proposal be approved, will adjust freight rates to destination points as the quoted price is f.o.b. Columbia.

"The domestic cement manufacturers refused to comply with the department's requirement and attempted to submit proposals that were apparently based on an understanding among them as to price," the statement continued, "the prices quoted by all of them being identical for the same point of delivery, and the delivered prices at the various points designated in their attempted proposals having no relationship whatever to the freight costs from the point of origin to the point of delivery.

"The domestic cement manufacturers attempting to submit these proposals were: Lone Star Cement Co., Alabama; Lone Star Cement Co., Virginia; Universal Atlas Cement Co., Chicago; Lehigh Portland Cement Co., Pennsylvania and Alabama; Alpha Portland Cement Co., Birmingham, Ala.; Pennsylvania-Dixie Cement Corp., Chattanooga, Tenn., and Volunteer Portland Cement Co., Knoxville, Tenn.

"Under the proposal of the Carolina Portland Cement Co., of Charleston, for furnishing foreign cement the cost per barrel, delivered at the various railroad points over the state, is estimated by the department at approximately 13 cents per barrel below the average of the uniform prices that the domestic cement manufacturers attempted to quote. The estimated aggregate amount of the saving to accrue from the purchase of foreign cement is approximately $130,000.

"If the tariff bill now pending in congress includes the proposed duty on cement of foreign manufacture and is applicable to cement purchased by the state, it is assumed that the highway department would be required to pay such uniform price as may be fixed by agreement among or combine of American or domestic manufacturers.

"We regard this as a serious situation and, therefore, will urge that the South Carolina delegation in congress do everything possible to prevent the imposition of an import tax."

New Wisconsin Granite Enterprise

THE GRANITE INDUSTRY in the Mellen district of Wisconsin received another inspiration recently when an announcement came to the effect that another granite company to be known as the Mellen Black Granite Co. had been formed and an application made to the state for an incorporate charter. Attorney Allen T. Prey of Ashland, Wis., is one of the incorporators.

For some time there have been negotiations under way for another granite company. There has been much activity in land options around Mellen and all land sought contains the famous black granite the same as the rock now being quarried by the Appleyard interests, the American Black Granite Co., east of Mellen.—*Ironwood* (Mich.) *Globe.*

Government Draws on Cement Industry for Another Foreign Minister

AS EVERY reader of newspapers knows, Hanford MacNider, chairman of the board of the Northwestern States Portland Cement Co., Mason City, Iowa, former assistant secretary of war, has been appointed United States minister to Canada. It will be recalled that this is the second appointment to the ranks of foreign diplomats of American cement manufacturers by President Hoover. The United States ambassador to Germany is F. M. Sackett, former vice-president of the Louisville Cement Co.

James Dick Re-enters Silica Sand Business at Falls Creek, Penn.

JAMES C. DICK, for more than a quarter of a century engaged in the silica sand business, and who recently sold his plant and sand bank at Polk, is once more engaged in the production of sand. The J. C. Dick Silica Sand Co. has taken over a modern plant at Falls Creek, Penn.

Associated with him in the company is John D. Hill, president of the Standard Life Insurance Co. of Pittsburgh; Fred C. MacMillan, vice-president of the Monongahela National Bank, of Pittsburgh, and A. H. Gaffney, president of the American Plate Glass Co., of Kane. Morgan W. Hall, formerly with the Jones and Laughlin Steel Co. for 20 years, is general superintendent of the plant.

The company has 1,250 acres of sand rock, with an average depth of 35 to 50 ft., and has a quarry face of about 4,000 ft. There are two 2½-yd. Marion shovels, one large capacity plant for washing sand, and one large capacity plant for molding sand; two caterpillar cranes for loading from the stockpile and three trains of standard gage cars, each train with a capacity of 60 tons.

The trains haul the product directly from the quarry to the mill. There is storage capacity for 80,000 to 100,000 tons of sand for winter shipment.

The plant is ideally located, with two direct railroad lines to Pittsburgh and Buffalo, and has a siding capacity for a train a day. A plant with this capacity and railroad facilities can furnish quickly the best type of product to consumers of the steel industry.

Friends of Mr. Dick, who recognize his ability in the sand business, are pleased to know of his active return to it, and more gratified to know that the office of the company is maintained in Franklin, on the third floor of the Lamberton Bank building.—*Franklin* (Penn.) *Herald.*

Miami Tile Contractors Form New Organization

ORGANIZATION of all tile, marble and terrazza contractors into an association which will be part of the Miami Builders' Exchange was announced by J. C. French, executive secretary of the exchange, following a meeting held at the exchange offices recently.

H. I. Homa, of the Miami Tile Co., was elected president of the new association; Frank T. Briggle of the Briggle Tile Co., vice-president; E. C. Hume of the Florida Granite and Marble Co., treasurer, and J. C. Herndon of the Briggle Tile Co., secretary.

The association was organized to provide a code of ethics in the industry and to see that owners of property are given a square deal, such as are specified in the architects' specifications.—*Miami* (Fla.) *Herald.*

News of All the Industry

Incorporations

Colfax Gravel Co., Inc., Alexandria, La., $75,000.

Gulf States Minerals Corp., Shreveport, La., $25,000. S. R. Elliott, 300 Spring St., Shreveport.

Devonian Marble Corp., Dover, Del., to deal in marble and limestone.

The Aerated Block Cement Co., San Francisco, Calif., 50,000 shares common stock, $10 par.

Master Marble Co., Clarksburg, W. Va., $50,000. Claude C. Grimmett, 316 North Ave., Clarksburg.

Atlas Plastering Co., Ltd., Montreal, Canada, $10,000.

Premier Sand and Gravel Co., Ltd., Vancouver, B. C., $100,000.

Moose Jaw Sand and Gravel Co., Ltd., Moose Jaw, Sask., Canada, $10,000.

Riviere-a-Pierre Granite Co., Ltd., Montreal, Canada, $20,000.

Eldorado Quarries, Ltd., Toronto, Canada, $25,000. Frank Howes, Herbert Howes and others.

Closter Stone Quarries, Inc., Englewood, N. J., $125,000. Adolph L. Engelke, Jersey City, N. J.

Bustrack and Dunn, Inc., Olympia, Wash., $40,000. To produce building materials. John Bustrack and Fred D. Dunn.

Universal Plastering Co., Inc., Providence, R. I., 300 shares common, no par value. To produce building materials.

Crystaline Products, Ltd., Hamilton, Ont., Canada, $10,000. To manufacture and deal in limestone, gypsum and by-products.

Trap Rock, Ltd., Bruce Mines, Ont., Canada, 40,000 shares preferred, par value $5 each, and 40,000 shares common, no par value.

Radford Limestone Co., Inc., Roanoke, Va., $5000. To operate limestone, dolomite or other stone quarries. Joseph H. Chitwood, president.

Marianna Lime Products Co., Marianna, Fla., increased capital stock to 1,200,000 shares, par value $5 each.

Penniman Gravel and Materials Co., Dallas, Tex., increased capital stock from $40,000 to $100,000.

Pasadena Supply Co., Newark, N. J., 2500 shares common. To produce building materials. Pitney, Hardin and Skinner, Newark.

Strathroy Granite and Marble Co., Ltd., Strathroy, Ont., Canada, $40,000. F. R. Hambly, G. W. Hambley, L. R. Hambley and others.

Farmers and Builders Supply Co., Inc., Sarasota, Fla., $10,000, divided into 100 shares, par value $100 each. F. P. Guynup, J. F. Baumgartner and M. M. Baumgartner.

Cement Trucking Service, 3820 W. Huron St., Chicago, Ill., $20,000. To deal in sand, gravel, cement, etc. Joseph Chavkin, John A. Balko and Charles H. Chavkin.

Marbles Northwest, Ltd., Winnipeg, Man., Canada, 500 shares preferred, par value $100 each, and 10,000 shares common, no par value. To produce and deal in stone, stone products, lime, etc.

Superior Lime and Cement, Ltd. (Nevada company incorporated in California), $2,000,000. R. E. Chalmers, Anderson Bldg., San Bernardino, Calif., agent.

Appleton Cement and Stucco Products, Inc., Appleton, Wis., $5000 (50 shares of $100 par value each). Robert L. Stader, F. W. Guenther and Floret Z. Guenther.

Chester Granite Quarries, Inc., Chester, Mass., $200,000 (2000 shares of $100 each). Fred P. Wagner, president; Edward M. Nolan, vice-president, and John J. Lester, 64 Oak Grove Ave., Springfield, Mass., treasurer.

The Kenhill Co., New London, Conn., $50,000 (500 shares at $100). To produce and deal in building materials. Max E. Underhill and Freeman E. Kenerson of New London and Irene I. Bush of Gales Ferry, Conn.

Quarries

The Batavia Limestone Co. has reopened the old Barker quarry south of Batavia, Ill., and is quarrying stone for building purposes.

Erie Stone Co., affiliated with the France Stone Co., Toledo, Ohio, has appointed N. E. Kelb, 410 Illinois Bldg., Indianapolis, as its Indiana agent.

Indiana Limestone Co., Bedford, Ind., reports the second best April in the history of the company, varying only slightly from April, 1927.

Woodsfield, Ohio. Work on the new Monroe Bituminous Concrete Co.'s plant is progressing rapidly and is expected to be completed by July 1. The company produces black top material from crushed limestone which is used for road construction.

H. E. Fletcher Co., West Chelmsford, Mass., has installed a complete drill steel shop equipment, consisting of a Gilman automatic forging furnace and an automatic heat-treating machine for treating all jackhammer and channel bar drill steels, together with a Gilman automatic combined forging and tempering furnace for plug drill steels.

Mississippi Quarries, Inc., Crystal Springs, Miss., after several months' work in grading and building a mile of railroad track, has its plant in readiness and the first shipments of stone have already been made on the 200,000-ton order which the company has received. The quarry is located five miles north of Crystal Springs.

Union, Maine. Despite rumors that the Great Northern Paper Co. planned to abandon its lime quarry at Union and the railroad which is used to carry the rock to Warren, Maine, work at the quarry is going on at full blast and it is expected that the operation will be continued for at least six months longer. The lime in the form of rough rock is shipped from the quarry to the company's paper mills, where it is used in the sulphite process. It is said that the Maine Seaboard mill at Bucksport will be supplied with lime from the quarry.

Cement

Lone Star Cement Co. of Pennsylvania, Philadelphia, Penn., subsidiary of the International Cement Corp., has moved from 123 South Broad St. to 225 South 15th St., Room 2818, Philadelphia.

Carolina Portland Cement Co., Atlanta, Ga., has received an order from the state of South Carolina for 4,000,000 bags of cement at a cost of $2,500,000 for use in highway work.

Beaver Portland Cement Co.'s plant at Goldhill, Ore., will close for 30 days due to a shortage of limestone caused by a slide of overburden late in May. It is said that some time will be required to establish working conditions at the quarry again, and in the meantime all the employes and some extra mechanics will be kept at work on annual repairs to the plant which usually are made later in the season. The company has a reserve supply of cement to supply orders during the shutdown.

St. Mary's Cement Co. is making good progress in the improvements now under way at its plant at St. Mary's, Ont. It is expected that early this fall the new giant kiln will be operating, and it is said that this will increase the output of the works from the present capacity of 1,000,000 bbl. a year to 1,750,000 bbl. The erection of the new kiln entails a number of added plant improvements, including new electrical equipment to handle the extra power needed, more storage room to provide for increased production, etc.

Sand and Gravel

Graham Bros., Inc., Long Beach, Calif., has taken over the Rancho plant at Roscoe, Calif., and is said to be merging several independent plants.

Stewart Sand and Material Co., Kansas City, Mo., will move its offices and storage yards to new quarters at Seventy-fourth street, Kansas City, Mo.

Ironwood, Mich. The crushing plant and other equipment used by the city in the operation of its gravel pit south of Ironwood has been moved to the new Spring Creek pit to be developed at North Ironwood. Tests indicate that the gravel in the north pit is of a high quality and that the supply will last for many years.

Louisiana Sand and Gravel Co. has completed the installation of a new washing unit at Sun, La., which, it is said, will practically double the production capacity of the company.

Western Sand and Gravel Co., Spring Valley, Ill., has acquired the interests and pit of the Colby Gravel Co. of Granville, Ill. The Colby company, it is understood, retains 14 acres of gravel land in close proximity to the pit.

Raritan River Sand Co., Nixon, N. J., has appointed Lewis Spinks vice-president, following the withdrawal of Charles E. and John B. Dalrymple as members of the firm. Walter G. Bornheimer has been made sales representative and Henry L. Eichler, plant superintendent.

Colton, Utah. The Utah county commission recently made an agreement with the state road commission for the purchase of a gravel pit near Colton. The county will acquire title to the tract and the state will lease the property under the agreement.

Allegheny River Sand Corp., Kittanning, Penn., invited all stockholders to visit the plant at Reesedale, Armstrong county, Penn., on May 15. The barges under construction and the hoist were inspected at Mahoning, and later the crushing and storage plants at Reesedale were visited. A luncheon was served by the company at Reesedale.

Bustrack and Dunn, Inc., incorporation notice of which appears in this issue, has been formed by John Bustrack, former manager of the Olympia Sand and Gravel Co., and Fred D. Dunn, former head of the General Lubricating and Distributing Co. Buildings to house the concern are now under construction on North Washington St., Olympia, Wash., and according to a recent announcement by Mr. Bustrack the firm will move into its new quarters within a few weeks.

Beder Wood's Sons Co., Consumers' Co. of Moline, Ill., and the **Builders' Sand and Gravel Co.**, Davenport, Iowa, have been made defendants in action brought by the state of Illinois to enjoin them from taking gravel from the pit along the River road near Moline on Route 80. The state is asking to recover $17,000 damages for gravel already removed. It is claimed gravel was taken from along the roadside. The new chart of the route places it more than an eighth of a mile from the pits.

Cement Products

Albert Salvatore's cement block manufacturing plant at 62 Portland Place, Yonkers, N. Y., was damaged recently to the extent of $2500 when a fire of unknown origin broke out in the plant.

Thomas Mihavetz, cement block producer of Trenton, N. J., has filed petition in bankruptcy in the U. S. District Court. Liabilities are listed at $1505.02, as against assets of $82.

Nashville Ready Mixed Concrete and Supply Co. has placed its new ready-mixed concrete plant in operation at Nashville, Tenn. The company is to furnish concrete for the Meharry college and the Montgomery Ward store buildings now under construction here.

The Standard Products Co., Medford, Ore., has sold a large block of its stock to the Willamette Art Tile Co. of Eugene, Ore., and the Eugene plant will now be removed to Rogue Valley. The Standard company manufactures floor tile of all colors from the natural rock in southern Oregon. The use of pumice rock, obtained from the upper Rogue river, is also employed in the process, which is patented by the company.

Miscellaneous Rock Products

Arkansas Bauxite Co., Little Rock, Ark., recently formed by Edgar G. Hanschke and associates, is planning the establishment of a new plant for the production of commercial bauxite. Bauxite properties have been acquired near Granite Mountain in Arkansas.

Diatom Products Co., Seattle, Wash., has purchased the plant of the former Panhandle Asbestos Co. at Kamiah, Idaho, from its owners, W. J. Ramey and F. F. Pomeroy, and has also taken a lease on the asbestos mine 15 miles east of Kamiah. The new owners expect to remodel the plant, put in new machinery and produce asbestos for commercial use. It is said that there is enough rock in storage to keep the plant in operation for several months.

Personals

J. E. Owsley has been named as third vice-president of the Pacific Coast Cement Co., Seattle, Wash.

James D. Sisler has resigned as associate geologist of Pennsylvania to become state geologist of West Virginia. He will assume his duties at Morgantown, W. Va.

William E. Balliet succeeds P. V. Kelly as manager of the Birmingham office of the Blaw-Knox Co., Brown-Marx Bldg., Birmingham, Ala. Joseph

More World Record Crushers

TWO 60-inch Allis-Chalmers Superior McCully gyratory crushers were built for the Chile Exploration Company of Chuquicamata, Chile, in 1926. These were, and still are, World Record Crushers in size, weight and capacity and are of all steel construction.

The crushers have given such satisfactory service, that two similar machines were ordered and are now being built for a large Nitrate Corporation for operation in Chile, South America.

In addition to the four all steel crushers, Allis-Chalmers has built two sixty-inch Superior McCully crushers of iron construction which are used for crushing limestone in this country.

All of these crushers are built with the proven features of Allis-Chalmers Superior McCully design giving large capacity, low maintenance and long life.

Allis-Chalmers builds all the principal machinery, including electrical equipment, for cement, crushing, screening, washing, and mining and metallurgical plants. Before you enlarge your old plant or build a new one it will pay you to call in an Allis-Chalmers engineer.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

When writing advertisers, please mention ROCK PRODUCTS

Riley will become assistant manager of the Birmingham district.

Francis A. Emmons, sales manager of Foote Bros. Gear and Machine Co., Chicago, Ill., has been elected vice-president in charge of sales and advertising of Gear Division Sales. Mr. Emmons started with Foote Bros. in 1924 as advertising manager and was appointed sales manager in 1926.

J. A. Voss has been appointed safety director of the newly formed Republic Steel Corp. He will be located in Youngstown and will have charge of safety matters in all the corporation's plants. He was formerly safety director of the Central Alloy Steel Corp. at Massillon, Ohio.

R. E. Haire, president of Gypsum, Lime and Alabastine, Ltd., Paris, Ont., Canada, left on May 30 for London on the C. P. S.S. "Duchess of Richmond" for a business and pleasure trip. The Canadian gypsum company which Mr. Haire heads is contemplating the establishment of a London office and plant in Great Britain, and while abroad Mr. Haire will study the British and European markets with this in mind.

Harold F. Kneen has been advanced to plant superintendent of the Lincoln Electric Co., Cleveland, Ohio. Mr. Kneen came to the Lincoln Electric Co. as assistant plant superintendent in June, 1929, previous to that time having held positions with the Indiana Flooring Co. as superintendent of its Ironton, Ohio, plant and as heat transfer engineer for the Ingersoll-Rand Co. **C. J. Bowers** has been appointed production manager of the Lincoln Electric Co.'s plant at Cleveland.

Ervin G. Bailey, president of the Bailey Meter Co., Cleveland, Ohio, and a widely known engineer, was awarded the Edward Longstreth medal by the Franklin Institute in recognition of his many inventions and developments of regulating and controlling devices and of measuring and recording instruments. Mr. Bailey is an inventor of considerable note and holds many patents on instruments and equipment used in the combustion field. He is also president of the Fuller Lehigh Co. at Fullerton, Penn., and a director of the Babcock and Wilcox Co. of New York.

D. R. Collins, vice-president of the Concrete Products Association, has also been elected secretary of the newly organized construction industry credit bureau, formed for the purpose of eliminating abuses and unbusinesslike financial arrangements in the construction and allied industries. The bureau will employ a force to collect and disseminate credit and other information on all lines of construction activities for the benefit of its members, which already include a number of concrete products manufacturers, crushed stone and sand and gravel producers.

Obituaries

G. S. Busboom, 32, president of the Carthage Marble Corp., Carthage, Mo., was killed in an airplane crash May 26 at Tulsa, Okla., with Bob Hammond, pilot of the airplane.

Patrick J. Morrissey, retired general superintendent of the Cleveland Quarries Co., died May 29 at his home in Berea, Ohio, at the age of 79. He was also a director and vice-president of the Commercial Savings Bank in Berea.

Walter Smart McKee, president of the Kensington Steel Co., Chicago, Ill., died May 19. Mr. McKee was one of the pioneers in the manganese steel casting business and had been actively identified with the development of that branch of the steel industry for the past 30 years.

Manufacturers

Wilbur G. Hudson Corp., New York City, announces the removal of its offices to 30 Church St., New York City.

Stephens-Adamson Manufacturing Co., Aurora, Ill., has moved its New York sales and engineering office to 50 Church St., Room 1360, New York City.

Republic Steel Corp., Youngstown, Ohio, has completed an additional 25-ton electric furnace at Canton, Ohio, enlarging the battery of electric furnaces to six, to meet the increased demand for its stainless steel made under the Krupp license.

The Goodyear Tire and Rubber Co., Akron, Ohio, will start construction of its South American plant near Buenos Aires around July 1, according to P. W. Litchfield, president. The new plant will be just outside of Buenos Aires at Hurlingham.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has contracted for a new building to be added to the electrical department at the West Allis plant. The new building will be 150x350 ft., two stories high, and will be erected at a cost of approximately $300,000.

American Steel and Wire Co., Chicago, Ill., has been appointed sole licensee in America of the Bleichert and Bleichert-Zuegg System of aerial tramways which transport passengers over vast distances with perfect safety, covering in a few minutes' time territory that would otherwise take hours or days to encompass.

Blaw-Knox Co., Pittsburgh, Penn., announces the addition to its sales staff of John E. Chiquoine. Mr. Chiquoine is a graduate of the University of Pennsylvania and has been connected successively with the American Chemical Machinery Co. and with the industrial engineering division of E. I. du Pont de Nemours and Co.

The Trackson Co., Milwaukee, Wis., announces the appointment of the Hunter Machinery Co., 16th Street Viaduct, Milwaukee, Wis., as a new distributor of Trackson tractor equipment. This company has branches located at 221 South Waterman Ave., Detroit, Mich., and at 530 Monroe Ave., N. W., Grand Rapids, Mich.

The Bethlehem Foundry and Machine Corp., Bethlehem, Penn., announces the appointment of W. S. Weaver, 609 Wright Callender Bldg., Los Angeles, Calif., as its western representative to succeed J. A. Kinkead. Mr. Weaver was for many years western manager of the Bates Valve Bag Co. and is very well known to the producers on the Pacific Coast. His prior experience has kept him in close contact with the industries he is now serving.

General Electric Co., Schenectady, N. Y., announces that the Oakland, Calif., and West Lynn, Mass., works of the company will be closed from July 4 to 20 for vacations, and that a skeleton crew of warehouse and maintenance men in each works will take care of requirements during the vacation period. The company also advises that its Philadelphia, Erie, Penn., and Bloomfield, N. J., works will be closed Saturday mornings during June, July and August this summer.

American Manganese Steel Co., Chicago Heights, Ill., has appointed John H. Coghlan as its representative in the New England states for the sale of Amsco manganese steel castings. Mr. Coghlan takes the place of Harrington, Robinson and Co. of South Boston, who formerly represented the company in this district, and has handled Amsco sales for many years while connected with Harrington-Robinson. His entire time will now be applied to Amsco business and he will maintain headquarters at 92 Broadway (Kendall Square), Cambridge, Mass.

Link-Belt Co.'s crane and shovel division, Chicago, Ill., has enlarged its sales organization with the recent appointment of the following companies as its direct representatives: W-D-M Equipment Co., Box 329, Columbia, S. C.; Myer and Cunningham, 30 Church St., New York City; Barzee Equipment Co., 1223 Burnet Ave., Syracuse, N.Y.; S. G. Hawkins Co., 723 Washington Ave., Houston, Tex.; Lewis-Patton Co., San Antonio, Tex., and West Virginia-Kentucky Hardware and Supply Co., Huntington, W. Va.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is inaugurating a group insurance plan for about 10,000 employes of the company, involving a total of approximately $20,000,000. Under this plan the general employes who have been with the company at least three months will each participate in $2000 of group life insurance, payable for death from any cause whatsoever. Employes will also have a total and permanent disability privilege, payable monthly for five years. The group insurance is being installed on a co-operative basis whereby the employes and the company both contribute to the cost.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Conveyors. Conveyor catalog attractively done in two colors, with close-up photographs of actual installations and full-size details of construction of Palmer-Bee conveyors. PALMER-BEE CO., Detroit, Mich.

Hydraulic Hoists. Folder on the new and improved slant type Wood hydraulic hoist for dump trucks, in seven models, designed for truck chassis from one ton upwards. WOOD HYDRAULIC HOIST AND BODY CO., Detroit, Mich.

Trap Rock. New folder outlining advantages of trap rock for road construction, and telling of tests made under the supervision of the U. S. Bureau of Public Roads. THE JOHN T. DYER QUARRY CO., Norristown, Penn.

Gyratory Crushers. Folder describing the Traylor "Grand-Daddy" Bulldog 54-in. gyratory crusher, weighing about 300 tons and standing 21 ft. high. TRAYLOR ENGINEERING AND MANUFACTURING CO., Allentown, Penn.

Steam and Electric Shovels. Folder entitled "Now Is the Time to Modernize," illustrating and describing Marion 1½-yd., 2-yd., 2¼-yd., 3-yd. and 4-yd. shovels. THE MARION STEAM SHOVEL CO., Marion, Ohio.

Conveyors. Bulletin on line of conveying equipment, including tipple conveyors, long wall conveyors, stationary conveyors, both drag and belt type, feeder conveyors and regular pit car loaders. NORTHERN CONVEYOR AND MANUFACTURING CO., Janesville, Wis.

Locomotive Cranes. The complete line of Industrial Brownhoist gas- and Diesel-powered locomotive cranes, including machines ranging from 10 to 40 tons capacity, is described in a new booklet, **No. 309**, just issued by INDUSTRIAL BROWNHOIST CORP., Cleveland, Ohio.

Pulverized Fuel Systems. General catalog **No. 4** completely illustrating and describing the engineering, construction and operation of "Purfeco" pulverized fuel equipment and complete powdered fuel systems. PULVERIZED FUEL EQUIPMENT CO., Chicago, Ill.

Pulverized Fuel Preparation. Bulletin **No. 2** illustrates and describes the Jones and Hartman system of preparing and firing pulverized fuel, and the units of this system, including the patented coal dryer and air-swept ball mill pulverizer. Completely illustrated with tables of specifications, etc. JONES AND HARTMAN, INC., Canton, Ohio.

Material Handling Equipment. "From Mother Earth to the Finished Highway" is the title of an interesting little booklet showing pictorially, as the title implies, the necessary equipment for the handling of sand, gravel and rock from the time it comes from the earth to the finished highway. IOWA MANUFACTURING CO., Cedar Rapids, Iowa.

Electric Flow Meters. Revised edition of the Electric Flow Meter Instruction Book, a 40-page illustrated book explaining the mechanism of the various types of Brown flow manometers, indicators and recording instruments and giving instructions for installing the equipment, adjusting the instruments for zero readings, and changing range tubes. Tables of correction factors for pressure, quality, and superheat of steam are given. THE BROWN INSTRUMENT CO., Philadelphia, Penn.

Material Handling Equipment. Folder outlining the history and growth of the Link-Belt organization and illustrating and describing its line of material handling equipment, including conveyors and elevators of all types, crawler and locomotive cranes, bridge tramways, car dumpers, unloading towers, portable loaders and unloaders, chains, wheels, buckets, etc. LINK-BELT CO., Chicago, Ill.

Air Compressors. Catalog **83-R**, a 40-page book, printed in two colors, describing the Sullivan line of portable gasoline engine driven compressors, which has recently been increased by the addition of a 66-ft. unit. Full details of the machines and their dimensions are shown, and approximately 14 pages of the catalog are taken up with numerous photographic illustrations of the equipment as used in the field. The book also devotes space to the description and listing of the Sullivan portable electric driven units. SULLIVAN MACHINERY CO., Chicago, Ill.

Excavators. Bulletin **450X** on the P & H excavator and crane, model 450, designed for fast line and swing speeds and convertible into shovel, dragline, trench-hoe, pile driver, skimmer-scoop, and crane. Bulletin **300-B** completely describes model 300-B unit cast steel ⅝-yd. excavator, with such salient features as a power clutch control for drum clutches, triple safety boom hoist driven by planetary gears, automatic trip rope takeup, etc. Bulletin **460-A** on model 400, a ¾-cu. yd. excavator, and model 600-A with capacity of 1 cu. yd., for handling aggregate and other excavating and material handling purposes. Bulletin **No. 650-A** covers model 650 1¼-cu. yd. excavator, provided with a rigid "fish-belly" type of shovel boom which, it is claimed, possesses unusual strength and reduces useless dead weight to a minimum. HARNISCHFEGER CORP., Milwaukee, Wis.

GEA Catalog and Bulletins. GEA-606B, "Industrial Control Catalog," consists of a reprint of the industrial control section of the general catalog 600A, and furnishes information on representative lines of industrial control manufactured by the General Electric Co. It also includes data on the care and operation of control devices, wiring diagrams of standard controllers, push buttons, and other accessories; reference tables; list of publications, and other useful information. **GEA-973A** illustrates and describes CR3100 drum controllers for series-, shunt- or compound-wound direct-current motors. **GEA-1252** covers the CR9440-LS415 hatchway limit switch for control circuits, designed for general-purpose applications, where it is desired to make or break a control circuit at a certain point in the travel of a part of the machine or mechanism. **GEA-246B** on general-purpose synchronous motors, Types TS and QS of the "7500" series, particularly suitable for loads whose torque requirements can be met by a standard squirrel-cage induction motor. **GEA-1229** on trolley type industrial haulage locomotives, 60-ton. **GEA-818A** describes the various types of G-E nonmetallic gears and blanks and gives price lists. **GEA-1043A** covers Fabroil gears, giving application data, dimensions and price lists. GENERAL ELECTRIC CO., Schenectady, N. Y.